Integrated ESIA Greece
Section 8 - Assessment of Impacts and Mitigation Measures
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8 ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

8.1 Introduction

This section identifies and assesses the environmental and socioeconomic impacts and risks of the Project in Greece\(^1\), and provides a description of the foreseen measures to address these\(^2\).

Significance of the residual impacts and risks is assessed taking the implementation of mitigation measures into account. These are either built-into the project design, \textit{i.e.} basically by the routing and siting efforts to avoid or minimise conflicts with the natural and socioeconomic (including cultural heritage) environments, and using best available techniques as a facility design reference, or are in addition identified as part of the assessment. The latter measures will need to be detailed and implemented in the final design of the Project.

Potentially relevant sources of impacts and risks were screened and identified through the ESIA scoping exercise\(^3\) which sets out:

\begin{itemize}
\item The technical, spatial and temporal scope assessed in the ESIA;
\item The interactions between Project activities and the receiving environments; and
\item The structured analysis of anticipated regular, cumulative and unplanned impacts associated with the Project.
\end{itemize}

This determined the study programme for the likely baseline receptors and the impact assessment studies to be undertaken.

An overview of the technical scope of the ESIA (i.e. the resources/receptors to be assessed) is presented in \textit{Table 8-1}. Further information on the resources/receptors potentially affected by the Project activities is provided in Section 6 \textit{Environmental, Social and Cultural Heritage Baseline}.

\(^1\)The general principles that underpin the approach to the impact assessment can be found in Section 5 ESIA Approach and Methodology, whilst Annex 5 details the topic-specific methodologies utilised for each of resources assessed.

\(^2\)The assessment is informed by a number of studies and supporting information, including \textit{a Hydrotest Concept} (ILF 2012, E.ON 2013) and a \textit{Logistics Concept} (ILF 2012, E.ON 2013). The assessment of impacts on designated protected areas and sites of conservation interest was informed by a \textit{Habitats Directive Assessment} (ERM 2012, ASP & EXERGIA 2013). The assessment of socioeconomic impacts and risks is further informed by a \textit{Human Rights Impact Assessment} study prepared (ERGON 2012, ASP & EXERGIA 2013).

The **spatial scope** of the ESIA depends on the respective resource/receptor and is detailed where appropriate in Annex 5. The spatial scope of the ESIA includes the assessment of transboundary impacts to neighbouring Albania and Turkey (refer to **Section 8.20**).

The **temporal scope** of the ESIA is restricted to the three main phases of the Project:
- Construction and Pre-commissioning;
- Operational and Maintenance; and
- Decommissioning and Reinstatement.

The duration of activities within each of these main phases can vary considerably (see **Section 4 Project Description** for details on the Project activities) and each has its own potential environmental and socioeconomic impacts and risks.

Pipeline **construction** is a sequential process and will last only a few weeks in each location. **Operation**, in contrast, covers a very long period. The design lifetime of the pipeline is 50 years; but it can well be anticipated, based on pipeline industry experience, that the pipeline could...
actually be used much longer. Decommissioning of the TAP system will take place in the future therefore impacts of this phase are assessed based on a number of assumptions4.

Impacts and risks resulting from non-routine operation scenarios and their mitigation are assessed in Section 8.18. The assessment of construction impacts also considers environmental and socioeconomic risks during that phase such as accidental spills to soil and water; traffic accident risk from logistics, socioeconomic community risks, social issues of employment including worker rights, etc. (these topics are dealt with qualitatively, whereas operational risks are also discussed in quantitative terms).

Cumulative impacts arising from the combination of activities associated with the Project together with other third party developments or projects in the same area of influence are assessed in Section 8.19.

As previously established, the assessment of impacts will be resource/receptor led. Each discussion (Sections 8.2 to 8.17) is presented in a systematic manner detailing the following:

- **Predicted impacts** – the sensitivity of the affected resource/receptor and the magnitude of the potential impact/risk, prior to the implementation of any mitigation measure;
- **Mitigation measures to address the impact / risk** – the key measures adopted, as well as a discussion on the various alternatives considered where appropriate; and
- **Significance of residual impacts** – the significance of any remaining impacts after the incorporation of mitigation, whether not significant, minor, moderate or major (major impacts are likely to be of high stakeholder concern).

As with other linear infrastructure, the most important and effective mitigation measure is avoidance of sensitive resources/receptors altogether through an informed route refinement and

---

4 It cannot be foreseen today which decommissioning approaches will be taken at the time of decommissioning. Impacts will obviously depend on the state-of-the-art decommissioning approach and available dismantling techniques at the time of decommissioning which cannot be foreseen today. Depending on the approach and technologies available at decommissioning stage, the pipeline may either stay in the ground or will be taken out partly or completely. Common international practice today, however with few precedent examples being available, is to leave an abandoned pipeline in the ground (abandonment-in-place). In this case the pipeline will be pigged, purged and filled with suitable material and secure it against structural collapse to avoid ground subsidence which will lead to subsequent impacts and risks to land use. If the pipeline will be taken out, e.g. to recover the pipe steel, activities will be similar to construction stage but in reverse order. It is assumed that in such a case similar types of equipment, machinery and vehicles will be used for decommissioning and similar impacts will occur which will need to be addressed by potentially similar mitigation. Any decommissioning activities will be subject to permitting requirements applicable at that time and subject to consultation with affected owners and stakeholders of affected properties and structures. A Pipeline Abandonment Plan that covers all relevant items will be prepared by TAG AG before any decommissioning works. Based on the above, for each environmental component the relevant more specific impacts are discussed under the 'Decommissioning' headings in the proceeding sections.
project component siting process. Key sensitivities such as valuable ecological features, settlements and cultural heritage resources can be avoided by the project footprint as far as possible, minimizing the need for mitigation. For this reason the Project has undertaken a comprehensive and iterative route selection/refinement process, as explained in Section 2 Project Justification, considering all environmental, social and engineering constraints along the pipeline corridor.

Impacts assessed in the following sections are therefore those that could not be avoided or mitigated further through route refinement and which require complementary mitigation measures. It should be clarified that the route refinement is an on-going process based on available constraints and data. The presented base case route, in the current ESIA, will be further refined and finalized upon receiving official comments by the competent authorities and other stakeholders. During the preconstruction phase, additional on-site route optimisation will be undertaken to further minimise potential Project impacts.

The present Section presents the measures to avoid, mitigate or offset adverse impacts and to minimise and manage risks on the environment, workforce and local population from Project activities that may cause harm or nuisance. Measures to increase, where possible, positive effects of Project implementation are also presented. The framework of all these measures is given in Section 9 Environmental and Social Management and Monitoring.

8.2 Climate and Ambient Air Quality

8.2.1 Overview

This Section assesses the potential impacts on local air quality as a result of the Project activities, as well as discussing the climatic impacts of Project emissions, including Greenhouse Gas emissions. Box 8-1 presents the key sources of impact, potentially impacted resources and receptors, the baseline and associated Project influencing factors.
Box 8-1  Key Considerations for Assessment – Climate and Ambient Air Quality

Sources of Impact/Risk

- Temporary dust emissions from earthworks, excavation, vehicle movement, stockpiles, unpaved surfaces, etc. along the working strip, access roads, yards and camps during Project construction.
- Temporary emissions of exhaust gases into the atmosphere from vehicles involved in Project construction (i.e. excavators, bulldozers, trucks, cars).
- Atmospheric pollutants emissions produced by the compressor stations GCS00 and GCS01 during the Project operations phase.

Potentially Impacted Resources and Receptors

- Residential population living near the construction site, workers and local vegetation.
- Human receptors of pollutants emitted by the compressor stations.

Particular Baseline Conditions that are Potentially Influencing Impacts/Risks

- The air quality field survey did not highlight any criticalities on macro pollutants concentration in the study area.

Project Factors that are Potentially Influencing Impacts/Risks

- Location of equipment at GCS00 and GCS01; amount of machinery in use during the construction phase; workers’ sites management, and traffic management, GCS00 and GCS01 layout and characteristics.

References

- Baseline is found in Section 6.2.6. Impact Assessment Criteria is found in Annex 5.6. Monitoring Measures are described in Section 9.2.

ERM (2012)

Table 8-2 presents the key potential impacts of the TAP Project on Climate and Ambient Air Quality during the key Project phases.

The results of the ambient air quality survey undertaken in the vicinity of GCS00 and GCS01 during the 2012-2013 field survey found low levels of both NOx and SOx, indicating good air quality. No relevant sources of dust or particulate matter were identified in the area. Background ambient air concentrations of pollutants of concern are therefore considered to be negligible in this area.

In the following Sections, each potential impact has been expanded providing a discussion of how each source is likely to have an impact on the receptor and the mitigation measures incorporated within the Project to reduce any negative impacts.
Table 8-2 Key Potential Impacts – Ambient Air Quality

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Temporary impacts on local air quality due to atmospheric emissions during the Project construction from construction machinery and vehicle movements. Main pollutant emitted will be PM (particulate matter, dust).</td>
<td>• Impacts related to the compressor stations activity. Main pollutants emitted are NO₂ and CO.</td>
<td>• Temporary impacts on local air quality mainly related to the GCS decommissioning and vehicle movements. Main pollutant emitted will be PM (particulate matter, dust).</td>
</tr>
<tr>
<td></td>
<td>• Vehicle movements’ associate with maintenance will be minimal, therefore no key potential impacts foreseen.</td>
<td></td>
</tr>
</tbody>
</table>

ERM (2012)

8.2.2 Construction and Pre-commissioning Phase

8.2.2.1 Potential Impacts

During Project construction, the potential impacts on local air quality are related to the following activities:

• Temporary dust emissions from earthworks, excavation, vehicle movement, stockpiles, unpaved surfaces, etc. along the working strip, access roads and work sites;

• Temporary emissions of exhaust gases into the atmosphere from vehicles (i.e. excavators, bulldozers, side booms, trucks, cars).

8.2.2.2 Dust Emissions

Dust emissions derive from the following activities:

• Pulverization and abrasion of surfaces, caused by trucks carrying soil and materials;

• Dispersion of dust particles caused by wind erosion of unpaved surfaces;

• Mechanical action on incoherent materials and excavation with excavators, bulldozers, etc.;

• Involuntary transport of mud by trucks wheels that produces dust when dried out.

Among the dust producing activities, the GCS00 and GCS01 construction, is potentially the most critical because of its duration (24 months) and its fixed geographical location. It should be noted
that other dust producing activities during the Project construction phase (i.e. working strip along pipeline route and access roads) will not have a fixed geographical locations activities will be moving along the route. Therefore, the effects on air quality along the pipeline route will only last for a number of days at a given location, depending on the speed of progress of pipeline construction. On average, the works in each spread will remain in progress for about 2-3 months. It is expected that dust emission in the drier months, during the summer period, will be higher than other times of the year.

Regarding the sensitive receptors within the 1,000 m corridor along the pipeline centreline, some settlements are located less than 200 m from the working strip (dust emission source). These settlements are the following: Kavissos with approximate distance 160 m (KP 16), Pefka with approximate distance 30 m (KP 28), Aetochori with approximate distance 95 m (KP 32), Agnantia with approximate distance 15 m (KP 35), Itea with approximate distance 190 m (KP 97), Ano Polysitos with approximate distance 35 m (KP 129), Vafeika with approximate distance 120 m (KP 136), Palaio Katramio with approximate distance 125 m (KP140), Pimni with approximate distance 75 m (KP 150), Gravouna with approximate distance 170 m (KP 165), Aspro with approximate distance 180 m (KP 411), and Polla Nera with approximate distance 90 m (KP 423.7). The magnitude of the impact at these locations (or settlements) is considered either small or medium, depending on the weather conditions - see Table 8-3.

<table>
<thead>
<tr>
<th>Weather Condition</th>
<th>Magnitude of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precipitation &gt; 0.2mm day-1, wind speed &lt;3 m/s</td>
<td>Small</td>
</tr>
<tr>
<td>Precipitation &lt; 0.2mm day-1, wind speed &gt;3 m/s blowing towards receptor</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Source: ERM (2012)
8.2.2.2.1 Emissions from Vehicles

With regards to vehicle emissions it should be noted that these emissions are diffused and will be limited, localised, and temporary. Exhaust emissions from construction related traffic can be considered as similar to those from regular traffic in municipal roads and as such their related impacts can be considered negligible if certain mitigation measures are followed.

Regarding the vehicle emissions in urban areas (i.e. Thessaloniki), by the transportation of pipes and other equipment, these will be estimated in relation to the results of Traffic Impact Study. Also, in this case emissions are diffused, localised and temporary.

8.2.2.3 Mitigation Measures

Generally, the applicable mitigation measures are good engineering practices for construction sites, including spraying of working areas and access roads with water, and washing of vehicles. More specifically the following good practice measures to minimise dust impacts from construction activities:

- Vehicles will be washed to remove any dusty materials from the body and wheels immediately before leaving a construction area or temporary facilities;
- Vehicles carrying soil or materials from/to the construction sites will be covered to minimise entrainment by the wind;
- Vehicle speed to be limited, especially during the dry season;
- The access routes will be kept clear of dusty materials or sprayed with grey water to maintain the entire road surface wet. More specifically, this measure has to be enforced in the following access routes: area of Valtochorion (~KP 379), area of Parthenion (~KP 382-383), scattered households at ~KP 391.5 - 393.5, scattered households at ~KP 403.5, scattered households at ~KP 408, household in Agios Loukas (~KP 409), area of Polla Nera (KP 428.5), scattered households at ~KP 478 - 479, scattered households at ~KP 492.5, scattered households at ~KP 494, area of Kleisoura (~KP 496), household in ~KP 500.5, area of Militsa (~KP 516), area of Poria (~KP 526.5), area of Chiliodendron (~ 528.5), area of Tsakoni (~KP 530) and household in ~KP 533. The working area will, when necessary, be sprayed with water to minimise the occurrence of dust. This practice
has to be enforced and in particular in the settlements located less than 200 m from working strip, as mentioned above.

Regarding mitigation measures from vehicle emissions, the following good practices are suggested:

- Training of drivers in careful driving, resulting to low vehicle emissions;
- Proper maintenance of equipment and vehicles.

### 8.2.2.4 Residual Impacts

*Table 8-4* summarises the residual impacts on air quality arising from the Project construction phase.

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measure to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction and Pre-commissioning Phase</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Vehicle Emissions | • Maintenance of equipment and vehicles.  
• Training of operators and drivers | NOT SIGNIFICANT  
• Construction traffic and machinery emissions are similar to existing traffic on municipal roads. Impact should be negligible with the anticipated mitigation measures in place. |
| Dust emissions to sensitive receptors when precipitation > 0.2mm/day, wind speed <3 m/s | • Washing of vehicles.  
• Cover of material in construction sites in order to minimise entrainment by wind.  
• Limited vehicle speed.  
• Spray with water to minimise occurrence of dust | MINOR  
• Reduced risk of dust pick-up. |
| Dust emissions to sensitive receptors when precipitation < 0.2mm/day, wind speed >3 m/s blowing towards receptor | Same mitigation measures as above | MODERATE  
• Higher risk of dust pick-up |

*Source: ERM (2012)*
8.2.3 Operation and Maintenance Phase

8.2.3.1 Potential Impacts

The key air emissions during operations will be produced from compressor station GCS00 and GCS01.

For the 20 bcm/year case the Compressor Station GCS00 will be equipped with 5+1 gas turbines with a total installed power of 75 – 90 MW (5 x 15 MW plus 1 x 15 MW idle as backup). Simultaneously for 20 bcm/year case, the Station GCS01 at Serres area will be equipped with 4+1 gas turbines with a total installed power of 100 - 125 MW (4 x 25 MW plus 1 x 25 MW idle as backup).

For the 10 bcm/year case the Compressor Station GCS00 will be equipped with 2+1 gas turbines with a total installed power of 30 – 45 MW (2 x 15 MW plus 1 x 15 MW idle as backup). The GCS01 is not required of 10 bcm/year case.

Air – emission modeling was carried out for the two Compressor Stations separately for their operation phase only. During the operation phase, each Compressor Station will be the only potentially relevant emission source.

The model and additional information on the emission scenario are provided in Annex 8.1. The results of the air emission model indicate that the operation of GCS00 and GCS01 does not cause significant impact on air quality. Potential sensitive receptors, i.e. populated places and Natura 2000 areas, in the airshed of the GSC00 and GSC01 were identified in order to analyze modeled ground level concentration at receptor locations. Town and villages contained within a radius of about 17 km from GSC00 and GSC01 are shown in Figure 8-1 and Figure 8-2, respectively.
Figure 8-1 Potentially sensitive receptors in the airshed of GCS00

Source: Demokritos (2013)
Figure 8-2 Potentially sensitive receptors in the airshed of GCS01

Source: ASPROFOS (2013)
Short-term air quality impacts, are assessed as **not significant** because all ground level concentrations (see modelling results presented in *Annex 8.1*) on sensitive receptors are below 25% of the assessment criteria, as defined in *Annex 5*. Only for Konstantinato, Skoutari and Vamvakousa. Minor impact levels were identified where the short-term concentrations of NO₂ may reach 32%, 45%, and 27% of the criterion. Specifically, all the predicted maximum concentrations of CO (daily 8 hr) and NOₓ (annual) at sensitive receptors are below 25% of the assessment criteria. Long-term Air Quality impacts are assessed either as **minor** or **not significant** for the pollutants examined and according to the respective assessment criteria:

Table 8-5  
Assessment of Air Quality Impacts at each Receptor from GSC00 (Kipoi) - 20 bcm/year

<table>
<thead>
<tr>
<th>Identified Potentially Sensitive Receptor</th>
<th>NOₓ (hourly)</th>
<th>NO₂ (annual)</th>
<th>CO (daily 8hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GREEK PART</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferres</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Gemisti</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Kipoi</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Lagina</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Lefkimi</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Lira</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Peplos</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Pylaia</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Provatonas</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Tavri</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Thymaria</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Tyheron</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Trifili</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td><strong>TURKISH PART</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ahir</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Balabancik</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Ipsala</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Saricaali</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Turpcular</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

Source: ASPROFOS (2013) and DEMOKRITOS (2013).

As evident from the table above the contribution from the compressor station GCS00 is not significant in most cases and only minor at some locations. Therefore, no adverse influence on the future ambient air quality in the airshed is to be expected.

The modelled incremental concentrations for NOₓ at the Natura 2000 area will also be not significant compared against the limit value for protection of vegetation.

By consideration of the baseline status, the assessment of impacts from the GCS00 station result in the same or less significant classification that shown in the above Table 8-5.
In *Table 8-6* below the results of the assessment for the 10 bcm/year operation of the pipeline for GCS00 station in Kipoi is presented. For all settlements in the study area the impact is *not significant*, with the exception of Peplos where it is minor.

### Table 8-6  Assessment of Air Quality Impacts at each Receptor from GSC00 (Kipoi) - 10 bcm/year

<table>
<thead>
<tr>
<th>Identified Potentially Sensitive Receptor</th>
<th>NO(_x) (hourly)</th>
<th>NO(_x) (annual)</th>
<th>CO (daily 8hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GREEK PART</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferres</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
</tr>
<tr>
<td>Gemisti</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
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<tr>
<td>Kipoi</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
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<tr>
<td>Lagina</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
</tr>
<tr>
<td>Lefkimi</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
</tr>
<tr>
<td>Lira</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
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<tr>
<td>Peplos</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not-significant</td>
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<tr>
<td>Pylaia</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
</tr>
<tr>
<td>Provatonas</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
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<tr>
<td>Tavri</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
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<tr>
<td>Thymaria</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
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<tr>
<td>Tiberon</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
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<tr>
<td>Trifili</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
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<tr>
<td><strong>TURKISH PART</strong></td>
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<tr>
<td>Ahir</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
</tr>
<tr>
<td>Balabancik</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
</tr>
<tr>
<td>Ipsala</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
</tr>
<tr>
<td>Saricaali</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
</tr>
<tr>
<td>Turpcular</td>
<td>Not significant</td>
<td>Not-significant</td>
<td>Not-significant</td>
</tr>
</tbody>
</table>

Source: ASPROFOS (2013)

In *Table 8-7* below the results of the assessment for GCS01 station in Serres is presented. As evident from the table the contribution from the compressor station is *not significant* in most cases and only *minor* for a number of settlements. Therefore, no adverse influence on the future ambient air quality in the airshed is to be expected.

The modelled incremental concentrations for NO\(_x\) at the Natura 2000 area near Serres will also be only minor or not significant compared against the limit value for protection of vegetation.
### Table 8-7  Assessment of Air Quality Impacts at each Receptor from GCS01 (Serres) – 20 bcm/year

<table>
<thead>
<tr>
<th>Identified Potentially Sensitive Receptor</th>
<th>NO\textsubscript{X} (hourly)</th>
<th>NO\textsubscript{2} (annual)</th>
<th>CO (daily 8hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serres</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Adelfiko</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Ag. Eleni</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Ag. Paraskevi</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Ag. Pnevma</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Ampeloi</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Ano Kamila</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Anthi</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Axinos</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Dimitritosio</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Eliaonas</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Em. Pappas</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Eptamyloi</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Flampouro</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Kala Dentro</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Kato Kamila</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Kato Hristos</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Konstantinato</td>
<td>Minor</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Kourmaria</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Kouvouklia</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Krisnos</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Lefkonas</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Ligaria</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Melenikitsi</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Mesokomi</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Mitrousio</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Monokklisia</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Monovrysi</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Nea Tyroli</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Neo Souli</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Neos Skopos</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Neoxori</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Nikoleia</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Oinoussa</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Palaikastro</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Paralimnio</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Pentapoli</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Peronia</td>
<td>Not significant</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Pethelinos</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Provatas</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Psihiko</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Sisamia</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Skotousa</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Skoytari</td>
<td>Minor</td>
<td>Minor</td>
<td>Not significant</td>
</tr>
<tr>
<td>Terpai</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Toumpa</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
</tbody>
</table>
The entire modelling was based on conservatively overestimating assumptions (continuous full load operation; all NOₓ considered as NO₂ meaning that all emitted NO has been converted into NO₂). Even in the case of this overestimation, no impacts on ambient air quality at receptor locations were identified which had to be classified as a moderate or major impact. All impacts were classified as not significant to minor.

### 8.2.3.2 Mitigation Measures

Due to the design of the compressor stations, including location and equipment selection, no additional mitigation measures are currently being considered at this stage of the Project.

However, it must be noted that according to JMD 29457/2005 (harmonization of the EU Directive 2008/50/EC) operational emissions NOₓ, CO, CO₂ will need to be monitored and sent to the relevant Greek authority for consideration.

### 8.2.3.3 Residual Impacts

In general, the impacts to ambient air quality from the compressor stations GCS00 and GCS01 during operation will be not significant or minor and therefore specific mitigation measures are not required.

*Table 8-8* summarizes the residual impacts arising from the Project operations phase.
### Table 8-8 Residual Impacts - Ambient Air Quality – Operation Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measure to Address the Impact / Risk</th>
<th>Significance of Residual Impact/ Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operation Phase</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| GCS00 (10 bcm/year) | • Location of compressor station is located away from sensitive receptors.  
• Maintenance of equipment and monitoring  
• Periodical air quality monitoring in the area of the GCS00 during a period of 1-2 years after start of operations to verify no impacts | NOx (hourly)  
**NOT SIGNIFICANT**  
All modelled locations were found to have insignificant impacts from the air emissions.  
NOx (annual)  
**NOT SIGNIFICANT to MINOR**  
Out of the 18 modelled locations only 1 was assessed as receiving a minor impact. Consequently, the residual impact from annual NOx emissions is deemed minor to not significant.  
CO (daily 8hr)  
**NOT SIGNIFICANT**  
All modelled locations were found to have insignificant impacts from the air emissions. |
| GCS00 (20 bcm/year) | • Location of compressor station is located away from sensitive receptors.  
• Maintenance of equipment and monitoring  
• Periodical air quality monitoring in the area of the GCS00 during a period of 1-2 years after start of operations to verify no impacts | NOx (hourly)  
**NOT SIGNIFICANT**  
All modelled locations were found to have insignificant impacts from the air emissions.  
NOx (annual)  
**NOT SIGNIFICANT to MINOR**  
Out of the 50 modelled locations only 3 were assessed as having minor impact. Consequently, the residual impact from annual NOx emissions is deemed minor to not significant.  
CO (daily 8hr)  
**NOT SIGNIFICANT**  
All modelled locations were found to have insignificant impacts from the air emissions. |
| GCS01 (20 bcm/year) | • Location of compressor station is located away from sensitive receptors.  
• Maintenance of equipment and monitoring  
• Periodical air quality monitoring in the area of the GCS01 during a period of 1-2 years after start of operations to verify no impacts | NOx (hourly)  
**NOT SIGNIFICANT**  
Out of the 50 modelled locations only 3 were assessed as receiving minor impact. Consequently, the residual impact from hourly NOx emissions is deemed minor to not significant.  
NOx (annual)  
**NOT SIGNIFICANT to MINOR**  
Out of the 50 modelled locations 16 were assessed as receiving a minor impact. Consequently, the residual impact from annual NOx emissions is... |
The design of the compressor stations minimizes the impacts to air quality during the operation phase. Therefore no other mitigation measure is needed.

8.2.4 Decommissioning Phase

It cannot currently be foreseen how exactly the pipeline system will be decommissioned 50 years from now. With regard to air quality impacts, much will depend if the pipeline will be abandoned *in situ* or if the pipeline will be recovered from the ground. In case the pipeline is taken out, similar ambient air impacts from ground works along the pipeline and from construction traffic will occur as for construction. The compressor station equipment will be disassembled and all buildings will be demolished and the sites reinstated. Dust emissions from the GCS site decommissioning will likely be less compared to construction since the decommissioning activities will be carried out on paved surfaces, mostly internal to the GCS site and particulate matter generation from demolition of buildings and surfaces can be reduced by suitable measures (e.g. screens and water spraying).

Residual impacts will be similar in nature to those that arise during construction, but with lower magnitudes. Similar mitigation measures anticipated for the construction phase with regards to the dust generation will apply. Taking the compressor stations out of operation will also cease the permanent emissions and thus relieve the airshed. No significant adverse air quality impacts to sensitive receivers in the vicinity are anticipated from decommissioning activities.

Impacts on air quality arising from the Project decommissioning phase can thus reasonably be assumed *not significant* for the dismantling activities and a positive impact for the airshed after decommissioning.
8.2.5 Project Climatic Emissions

8.2.5.1 Local Micro- and Regional Meso Climate

Since the pipeline will be installed underground, with the pipeline strip reinstated without surface sealing, and the compressor stations will be situated on open fields, there is no potential that the Project has any significant impact on local or regional climatic conditions, such as windfields, cold air generation and flow. The hot exhausts from the gas turbines will disperse with the uplift and have no effect on local or regional climate. Also, since there are no cooling towers at the compressor station, aspects such as cloud or fog generation will not arise.

8.2.5.2 Greenhouse Gas (GHG) Emissions

Operation of GCS00 and GCS01 will result in Greenhouse Gas Emissions. The calculation below is based on the worst case scenario of the 20 bcm/case, both compressor stations running full load throughout the year. The calculation also considers venting activities. Fugitive emissions are estimated to be a negligible contributor to overall GHG emissions.

The GCS00 will operate with Natural Gas. This translates into an output of 47.5 tones CO₂/h since the compressor station will be running all year, only with a short venting interruption, the full annual hours can be calculated. Considering the oxidation and conversion factor for CH₄ combustion emissions, the operation of GCS00 will result in 414,020 tones CO₂/year⁵. In addition to this combustion emissions, as part of the annual depressurization of the station there will be a single, direct release (no combustion) of natural gas to the atmosphere through venting. This will amount to 230 tonnes of natural gas (CH₄) per year. The GHG Global Warming Potential of CH₄ is 21 times that of CO₂, so a single planned depressurization will result in an equivalent emission of 4,380 tons CO₂/year.

The GCS01 will operate with Natural Gas. This translates into an output of 61.5 tonnes CO₂/h. Using the same calculation approach with GCS00 will result 536,046 tonnes CO₂/year from the compressors. In addition to these combustion emissions, as part of the annual depressurization

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⁵Calculation: The total hourly rate of CO₂ for GCS00 and GCS01 are 47,500 kg/h (or 418,020 t/year) and 61,500 kg/h (or 538,740 t/year) respectively. The equivalent emission of CO₂ derived from CH₄ is 4,830 t/year CO₂. The oxidation and conservation factor for CH₄ combustion is 0.995 (as per Emission factors: 2007/589/EC)
of the station there will be a single, direct release of natural gas to the atmosphere through venting. This will amount 230 tonnes of natural gas (CH$_4$) per year. This will result in an equivalent emission of 4,380 tonnes CO$_2$/year.

Thus in total for the 20 bcm/year case GCS00 and GCS01 will emit approximately 958,826 tonnes CO$_2$/year. The impact is considered as **moderate**.

Data from the European Environment Agency$^6$ indicate that Greek emissions of GHG in 2010 were estimated to be 120.3 million tonnes (CO$_2$ equivalent). Predicted GHG emissions from GCS00 and GCS01 will account for approximately 0.8% of total annual national emissions. Therefore the contribution is considered to be **not significant** on the GHG balance in Greece.

During first phase of the project (10 bcm/year) stage GCS00 will only be equipped with 2+1 gas turbines (30-45 MW). So the GHG emissions for the 10 bcm case will be approximately 169,988 tonnes CO$_2$/year. There would be no emissions from GCS01. The overall impact during phase 1 is considered **moderate**.

Whilst the absolute GHG emissions from the compressor station operation itself cannot be minimized, the Project has investigated the possibilities to increase energy efficiency by making use of the excess heat that is wasted in the gas turbines by adding a steam cycle. This is not yet common for gas pipeline compressor stations; presently only about two such stations are under construction in central Europe; and these are larger dimensioned than GCS. Also around the sites of GCS there are no potential off-takers for process steam which will be another option for efficient energy use. Independent generation of power for the electricity grid is not within TAP AG’s operation philosophy. A potential technological option will be the installation of a combination of gas turbine and steam turbine driven turbo compressors. In this case the excess heat from gas turbine driven compressors will be used to produce steam to operate one or more steam turbines connected to a turbo compressor for gas compression. However, TAP AG for the time being is not pursuing such a concept as it adds technological and operational complexities at disproportionate costs. In addition, particularly during the first phase of the project (10 bcm/year case), the installed compressor power is too small to implement such a system.

In order to track GHG emissions, TAP AG will submit an annual *Carbon Emission Report* for GCS00 and GCS01 to the MEECC and make this report available to project lenders as required.

### Summary of Impacts on Ambient Air Quality

**Construction and Pre-Commissioning Phase:**

Project construction may lead to local nuisances from dust generated by earthworks (i.e. working strip preparation and trenching) and construction traffic. Standard mitigation measures such as dust suppression by water spraying will be applied where dust generating activities like earthworks or transport on unpaved roads take place in the immediate vicinity of settlements. Despite the long duration of works within the compressor stations construction site, the nearest settlements are over 1 km away and unlikely to be affected by dust.

**Operation and Maintenance Phase:**

Project operations are also not anticipated to result in significant impacts on the airshed along the pipeline route which is characterised as being relatively unpolluted, as expected for these predominantly rural regions.

The compressor station will be fuelled with natural gas. The results of the dispersion model show that the operation of the compressor station does not lead to any critical increase in NOx short or long term concentrations at sensitive receptors in the relevant airsheds when compared to EU limit values.

Specific emissions from the operation of compressor station GCS00 are relatively low when compared to other conventional thermal power generation, due to the use of natural gas. The GCS00 emit approximately 414,020 tones CO₂/year. Specific GHG emissions from the operation of GCS01 are relatively low and emit approximately 536,046 tonnes CO₂/year. In general, the compressor stations simultaneously operation will account for 0.8% of the total annual national GHG emissions.
8.3 Acoustic Environment

8.3.1 Overview

This section assesses the impacts on the ambient acoustic environment of the study area that may arise from the construction, operations and decommissioning phases. Impacts on fauna from noise emitted by the construction and operation of the project are included in the relevant sections of the terrestrial ecology (Section 8.7) and protected areas (Section 8.9).

During construction sources of impact are related to machinery noise emissions that have a prevalent effect on the area adjacent to the working strip / site. Noise sources in this phase will be temporary in nature, and depend on the number and type of machinery items used for each activity. The noisiest activities during construction will predominantly be concentrated at the pipeyards and pipeline sections that require hammering or blasting for trench preparation, in the hydrotesting water source and, mainly, at discharge points, and the construction of the compressor station GCS00 (and GCS01 at a later phase of the project, where the operating capacity will be 20 bcm/y). Any heavy ground works (i.e. hammering and blasting, and piling foundations for permanent structures i.e. BVSs) also have the potential to generate vibrations. Depending on the soil characteristics and on the distance to the nearest settlement, these activities could produce critical vibrations for houses in the vicinity, especially if built with wooden beam floors and ceilings or if they are historic building structures.

The operation of the pipeline will not be a significant source of noise itself. The following Box 8-2 presents the key sources of impact, potentially impacted resources and receptors, baseline and Project influencing factors associated with the Project on the ambient acoustic environment.

Table 8-9 presents the key potential impacts of the Project on the acoustic environment during the Project phases. Noise impacts on fauna are considered Section 8.7.2.1.4 and 8.7.2.1.5.
Box 8-2 Key Considerations for Assessment – Acoustic Environment

Sources of Impact/Risk

- Construction Phase: noise and vibration from equipment and machinery. Construction of pipeline (incl. hammering/blasting), BVS, and Compressor Stations (including foundation piling). Construction of temporary facilities (working sites).
- Operation Phase: noise from Compressor Stations (initially GCS00 and GCS01 at a later stage).
- Decommissioning Phase: noise and vibration from equipment and machinery. Removal of installations.

Potentially Impacted Resources and Receivers

- Any nearby settlements and households.
- Fauna present in the locality of construction site.

Particular Baseline Conditions that are Potentially Influencing Impacts/Risks

- The ambient noise baseline monitoring did not highlight specific criticalities in the study area because the pipeline route crosses mostly agricultural and undeveloped areas.

Project Factors that are Potentially Influencing Impacts/Risks

- Amount and type of machinery in use during the construction phase and the camp sites; specific techniques used for hydrotesting and trenchless crossing; water management; workers’ sites management, waste management and traffic management.
- Construction times

References

- Baseline is found in Section 6.2.7. Impact Assessment Criteria is found in Annex 5.5. Monitoring Measures are described in Section 9.2.


Table 8-9 Key Potential Impacts – Acoustic Environment

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disturbance of nearby settlements from working sites (pipeline and installations, sheet piling, hammering and blasting activities)</td>
<td>Disturbance from Compressor Stations Noise Emissions (potential sleep disturbance of stress)</td>
<td>Disturbance of nearby settlements from working sites</td>
</tr>
<tr>
<td>Potential for sleep disturbance; day and night-time nuisance and potential stress from construction activity noise</td>
<td></td>
<td>Potential for sleep disturbance; potential stress from decommissioning activity noise</td>
</tr>
<tr>
<td>Potential temporary disturbance and/or displacement of fauna (e.g. reduction of usable habitat) from construction activity noise</td>
<td></td>
<td>Potential temporary disturbance and/or displacement of fauna (e.g. reduction of usable habitat) from decommissioning activity noise</td>
</tr>
</tbody>
</table>


It is noted that noise originating by transportation of equipment and machinery is also a potential source of impact during construction phase but this is addressed in the relevant section (Section 8.16). In the following sections, each potential impact has been expanded to provide a discussion of how each source is likely to have an impact on the receptor and the mitigation measures incorporated within the Project to reduce any negative impacts.
8.3.2 Construction and Pre-commissioning Phase

8.3.2.1 Potential Impacts

Impacts on the acoustic environment are likely to occur during the following construction activities:

- Pipeline laying and construction of temporary facilities;
- Blasting and hammering; and
- Trenchless crossings (Horizontal Directional Drilling (HDD) technology has been assumed).

Several types of equipment are expected to generate high levels of noise during Project construction. A typical list is presented in Table 8-10.

<table>
<thead>
<tr>
<th>Table 8-10 Construction Equipment Noise Levels</th>
<th>Total noise pressure level [dB(A)] at</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50m</td>
</tr>
<tr>
<td>Construction of Pipeline</td>
<td></td>
</tr>
<tr>
<td>Preparation Working Strip</td>
<td>71,0</td>
</tr>
<tr>
<td>Top Soil Stripping and Grading</td>
<td>76,8</td>
</tr>
<tr>
<td>Pipe Stringing</td>
<td>61,6</td>
</tr>
<tr>
<td>Pipe Bending</td>
<td>74,0</td>
</tr>
<tr>
<td>Pipe Welding</td>
<td>74,0</td>
</tr>
<tr>
<td>Joint coating</td>
<td>76,8</td>
</tr>
<tr>
<td>Trench Digging</td>
<td>76,5</td>
</tr>
<tr>
<td>Pipelaying</td>
<td>74,8</td>
</tr>
<tr>
<td>Hydrotesting</td>
<td>65,6</td>
</tr>
<tr>
<td>Dewatering and drying</td>
<td>58,4</td>
</tr>
<tr>
<td>Backfilling and reinstatement</td>
<td>74,9</td>
</tr>
<tr>
<td>Replacement of Topsoil</td>
<td>77,4</td>
</tr>
<tr>
<td>Construction of GCS00 &amp; GCS01</td>
<td></td>
</tr>
<tr>
<td>Site preparation</td>
<td>74,5</td>
</tr>
<tr>
<td>Construction</td>
<td>74,8</td>
</tr>
<tr>
<td>Trenchless Crossings</td>
<td></td>
</tr>
<tr>
<td>HDD</td>
<td>68,3</td>
</tr>
</tbody>
</table>


Noise levels reduce with increasing distance from the source. Generally doubling the distance from the source will decrease levels by 6 dB(A). Therefore, assuming that noise measurements
are taken 1 m from the emitting source, it can be estimated that noise emitted at 100 dB(A) is perceived as 70 dB(A) at a distance of 32 m.

In order to assess the noise impacts of the various pipeline construction activities, noise emission calculations were carried out to determine sideline distances at which compliance of the major, moderate and minor criteria are achieved. The calculations in Table 8-11 assume propagation over flat, soft ground (i.e. open grassland) to a typical receptor. As the receptor is anticipated to be at a relatively short distance, the noise level calculations do not include any meteorological enhancement, for example due to a slight breeze towards the receptor, or due to a temperature inversion.

### Table 8-11 Offset Distances to Comply with Design Criteria – Isolated Residences

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Main construction activities</th>
<th>50dB(A)</th>
<th>40dB(A)</th>
<th>30dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trench construction</td>
<td>Chain trencher/ wheel trencher, excavator</td>
<td>350m</td>
<td>600m</td>
<td>750m</td>
</tr>
<tr>
<td>Pipe preparation</td>
<td>Grit blasting</td>
<td>220m</td>
<td>420m</td>
<td>560m</td>
</tr>
<tr>
<td>Pipe unloading laying and</td>
<td>Sideboom tractors, graders, rollers</td>
<td>200m</td>
<td>400m</td>
<td>520m</td>
</tr>
<tr>
<td>rehabilitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous Works</td>
<td>Daymakers, pumps, generators</td>
<td>120m</td>
<td>260m</td>
<td>370m</td>
</tr>
</tbody>
</table>


Through the pipeline route refinement process receptors potentially sensitive to increases in noise have been avoided as much as possible and the boundary of only a few settlements are located less than 200 m from the working strip (source of construction noise). These settlements are presented in Table 8-12.

### Table 8-12 Settlements located less than 200 m from working strip

<table>
<thead>
<tr>
<th>Main construction activity (source of construction noise)</th>
<th>KP</th>
<th>Settlement</th>
<th>Approximate Distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction works (trench excavation, pipe laying, miscellaneous)</td>
<td>16</td>
<td>Kavissos</td>
<td>160</td>
</tr>
<tr>
<td>Construction works (trench excavation, pipe laying, miscellaneous)</td>
<td>28</td>
<td>Pefka</td>
<td>30</td>
</tr>
<tr>
<td>Construction works (trench excavation, pipe laying, miscellaneous)</td>
<td>32</td>
<td>Aetochori</td>
<td>95</td>
</tr>
<tr>
<td>Construction works (trench excavation, pipe laying, miscellaneous)</td>
<td>35</td>
<td>Agnantia</td>
<td>15</td>
</tr>
<tr>
<td>Construction works (trench excavation, pipe laying, miscellaneous)</td>
<td>97</td>
<td>Itea</td>
<td>190</td>
</tr>
<tr>
<td>Construction works (trench excavation, pipe laying, miscellaneous)</td>
<td>113</td>
<td>Galini</td>
<td>181</td>
</tr>
<tr>
<td>Construction works (trench excavation, pipe laying, miscellaneous)</td>
<td>129</td>
<td>Ano Polysitos</td>
<td>35</td>
</tr>
</tbody>
</table>
Based on the criteria described in Section 5 and Annex 5, at these receptors the impacts are considered as moderate. Noise impacts to receptors further than 200 m from the source of noise impacts are considered as minor.

In areas of hard ground regular trenching (digging) equipment requires support by ripping, hammering or even blasting. Ripping can be done in close proximity to populated areas or other places where blasting noise and vibrations are restricted. However, ripping is limited to soft to moderately firm, fractured rock and construction of low-angle cut slopes and shallow, near vertical cuts. In dense rock formations, hammering or light blasting will be sometimes required before ripping (Description of Excavation Methods - Doc. Ref CPL00-ILF-100-F-TRS-0001 - Rev.: 0D). Blasting will typically be required if the portion of the solid rock in the trench section is above 50%. Explosives portioned in micro-charges will be introduced into the ground via a series of holes that are drilled by drilling machines. The progress of the drilling (one machine) is typically about 1 – 2 km per week (over 5 working days). Drilling machines will produce continuous noise levels of typically around 84 dB(A). Blasting noise source levels are typically in the range of 70 and 90 dB (A) at a distance of 5 m.

Based on the present knowledge of subsurface and geotechnical conditions, sections where blasting and hammering is expected to occur are included in the following table (Table 8-13). Sensitive social receptors that may be affected from such activities are also included, along with an approximate distance from the assumed noise source (noise source is assumed to be at the pipeline’s centreline).
### Table 8-13 Settlements located in proximity to potential areas of blasting or hammering activities.

<table>
<thead>
<tr>
<th>Main construction activity (source of construction noise)</th>
<th>From KP</th>
<th>To KP</th>
<th>Length (km)</th>
<th>Potentially Affected Settlements</th>
<th>Approximate Distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blasting and Hammering</td>
<td>18</td>
<td>20</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>27</td>
<td>32</td>
<td>5</td>
<td>Pefka Aetochori</td>
<td>30, 95</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>49</td>
<td>64</td>
<td>15</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>177</td>
<td>179</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>181</td>
<td>194</td>
<td>13</td>
<td>Chalkero Neos Zygos</td>
<td>220, 553</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>225</td>
<td>230</td>
<td>5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>295</td>
<td>328</td>
<td>33</td>
<td>Kefalochori Evaggelistra</td>
<td>234, 389</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lachanas Isoma Karteres</td>
<td>231, 833, 724</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>340</td>
<td>342</td>
<td>2</td>
<td>Drymos Melissosochori</td>
<td>496, 810</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>343</td>
<td>347</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>348</td>
<td>349</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>425.8</td>
<td>438.3</td>
<td>12.5</td>
<td>AgiaFotini</td>
<td>250</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>447.8</td>
<td>448.8</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>451.8</td>
<td>455.8</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>486</td>
<td>488.5</td>
<td>2.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>491.4</td>
<td>495.5</td>
<td>4.1</td>
<td>Kleisoura</td>
<td>120</td>
</tr>
<tr>
<td>Blasting and Hammering</td>
<td>536.4</td>
<td>542</td>
<td>5.6</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>


Blasting activities during the construction phase will be brief in nature, will not take place during the evening or at night, and potentially exposed populations will be informed of the activities in advance. No significant impact is expected from blasting and therefore associated noise and vibration levels have not been estimated.

In the vicinity of where trenchless techniques will be used all settlements and households are at a distance of more than 200m, and therefore the noise from this activity will not impact the ambient acoustic environment of any sensitive receptors. Of course, this depends on the final layout of the trenchless crossing construction site, which will be determined at a later stage of the project. Special care should be given at the crossings of Kompsatos (aka Xiropotamos) and Nestos Rivers. Galini settlement is located at approximately 500 m from the current crossing point with Kompsatos River and Krini settlement is located at approximately 750 m from the current crossing point with Nestos River.
It should be also noted that based on the available data, no settlements exist within 200 m from sites where hydrotesting water may be extracted or discharged (see Section 4 for details regarding hydrotesting). Nevertheless, upon finalization of these sites, assessment should be verified.

8.3.2.2 Mitigation Measures

Based upon the above, the following measures are recommended to reduce, regulate and limit acoustic and vibration impacts from the construction of the proposed Project:

- Ensure that work to establish construction camps and pipeyards, and construction activity for the pipeline, Compressor Stations and BVSs occurs between the hours of 0600 and 2200 (exceptions only as outlined below);
- Where construction activities must occur outside of the above hours, either an additional noise assessment or on-site noise monitoring will be undertaken. This will be particularly relevant to the hydrostatic pressure testing of the pipeline which occurs over a 24 hour period. Once the locations that the hydrostatic compressor will be located are known, an assessment of the noise at the nearest noise sensitive location will be made;
- Ensure that all construction activity incorporates techniques for the control of noise to noise-sensitive land uses in the vicinity.
- If work is to be conducted in a residential area or other noise-sensitive location, use the lowest-noise work practices and equipment that meet the requirements of the job.
- All mechanical equipment is to be silenced by the best practical means using current technology.
- Mechanical equipment, including noise-suppression devices, should be maintained to the manufacturer’s specifications. Internal combustion engines are to be fitted with a suitable muffler in good repair.
- Fit all pneumatic tools to be operated near a residential area with an effective silencer on their air exhaust port.
- Install less noisy movement/ reversing warning systems for equipment and vehicles that will operate for extended periods, during sensitive times or in close proximity to sensitive sites.
- Occupational health and safety requirements for use of warning systems must be followed:
- Turn off equipment, including vehicles, when not being used.
- All vehicular movements to and from the site to only occur during the scheduled normal working hours, unless approval has been granted by the relevant authority.

- Where possible, no truck associated with the work shall be left standing with its engine idling in a street adjacent to any residential area.

- Notification/engagement of stakeholders regarding scheduling of blasting or hammering activities near sensitive areas. Additional noise monitoring, during blasting or hammering activities near sensitive receptors, should be applied if required.

- Carefully design trenchless crossings construction layouts, especially near Kompsatos and Nestos Rivers in order to avoid as much as is technically possible noise impacts to Galini and Krini settlements, respectively.

- Use of best practice techniques (i.e. mats, micro-charges etc.) in proximity of sensitive receptors.

- In areas, where blasting and hammering is going to happen near standing buildings, a Pre-Construction Conditions Assessment of the structure will be undertaken in order to assess potential damages caused by the project.

- If previously unidentified structures are within proximity to the working strip/site (less than 200 m) a Pre-Construction Conditions Assessment of the structure (existing cracks etc.) will be undertaken in order to be able to objectively assess if actual damage has resulted from construction.
8.3.2.3 Residual Impacts

*Table 8-14* summarises the residual impacts on the ambient acoustic environment during the construction phase.

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measure to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| Pipeline & Compressor Stations construction | Rceptors located within 200 m from work areas | • All construction activity to occur between the hours of 06:00 and 22:00 (7 days per week), unless a further environmental noise assessment is undertaken.  
• Noise-reduction technologies in the equipment and machinery (i.e. silencer)  
• Use of the lowest noise work practices and equipment.  
• Good maintenance.  
• Turn off equipment and vehicles when not being used.  
• All vehicular movements to and from the site to only occur during the scheduled normal working hours.  
• Where possible, no truck to be left standing with its engine operating in a street adjacent to a residential area. | MODERATE  
• Foreseen noise level >50 dB(A) for most construction works as illustrated in *Table 8-11* (level determined by WHO, see Annex 5)  
• Temporary disturbance |
| Trenchless techniques (HDD) | Rceptors located >200 m from work areas | • Carefully design of construction layouts in order to avoid as much as technically possible noise impacts to nearby residential areas. | NOT SIGNIFICANT  
• All receptors at locations where HDD is being considered should be at a distance of more than 200 m |
| Blasting and hammering | | • All construction activity to occur between the hours of 06:00 and 22:00 (7 days per week)  
• Use of best practice techniques (i.e. mats, micro-charges etc.) in proximity of sensitive receptors  
• Notification/ engagement of stakeholders of blasting or hammering activities near sensitive areas. Additional monitoring if required. | NOT SIGNIFICANT  
• Temporary and sporadic events in limited locations |

*Source: ERM (2012) & ASPROFOS (2013)*
8.3.3 Operation and Maintenance Phase

8.3.3.1 Potential Impacts

The only regular noise emissions during operation will be produced from the operation of the Compressor Stations (initially only GCS00, near Kipoi, and in the next development phase of the project, i.e. for the 20 bcm/year, from GCS01, near Serres, as well). For the assessment of noise impacts during the operation of both GCS00 and GCS01, a special noise propagation model was prepared by Genest und Partner, Ingenieuresellschaft mbH, in February – March 2013 (see Annex 8.2 GCS00-WGP-000-S-TRS-0001_00--Noise Control Study GCS00 and Annex 8.3 GCS01-WGP-000-S-TRS-0001_00--Noise Control Study GCS01)\(^7\). The emission source levels for the station components used in the modelling study for each Compressor Station are provided in the relevant above mentioned studies (see Annex 8.2 and Annex 8.3).

Based on the initial development phase of the project, i.e. of 10 bcm/year, the noise contour map and the sensitive receptors of GCS00 are illustrated in Figure 8-3. Figure 8-4 illustrates the noise contour map and the sensitive receptors for GCS01. It is highlighted that GCS01 will be initially developed as a scraper station, with rare if any no noise emissions; only for the final development of the project of the 20 bcm/year will GCS01 produce noise emissions.

\(^7\) It should be noted that during the ongoing design of the project, GCS01 layout was rotated for approximately 180°. This modification is not included in the noise modelling studies but, according to experts judgment no significant modification of the impacts should be expected. No modification to the noise impacts assessment is expected, mainly because of the significant distance of the closest sensitive receptor.
Figure 8-3  Noise contour map for GCS00 and nearby communities

Source: GCS00-WGP-000-S-TRS-0002_00
Regarding GCS00, small differences in the propagation of the noise are calculated for the 20 bcm/year phase. Nevertheless, impacts on the sensitive receptors are not altered between the two development phases of the project (for details see Annex 8.2). For both GCS00 and for GCS01, the model has calculated that the additional noise will not exceed 3 dB(A) (a limit set by IFC) at the background noise level of any social receptor (see Table 8-15 for the initial development phase for GCS00 and Table 8-16 for GCS01).
### Table 8-15  GCS00 operation noise at sensitive receptors (initial development stage)

<table>
<thead>
<tr>
<th>s/n</th>
<th>Sensitive receptor</th>
<th>Approximate Distance (m)</th>
<th>Initial noise level at night time in dB(A)</th>
<th>Additional Noise level at night time in dB(A)</th>
<th>Total Noise level at night time in dB(A)</th>
<th>Increase of background noise in dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Thymaria</td>
<td>2,650</td>
<td>29.4</td>
<td>20.6</td>
<td>29.9</td>
<td>0.5</td>
</tr>
<tr>
<td>2</td>
<td>Tavri</td>
<td>2,900</td>
<td>29.4</td>
<td>21.4</td>
<td>30.0</td>
<td>0.6</td>
</tr>
<tr>
<td>3</td>
<td>Peplos</td>
<td>1,650</td>
<td>29.4</td>
<td>25.7</td>
<td>30.9</td>
<td>1.5</td>
</tr>
<tr>
<td>4</td>
<td>Kipoi</td>
<td>2,250</td>
<td>29.4</td>
<td>18.7</td>
<td>29.8</td>
<td>0.4</td>
</tr>
<tr>
<td>5</td>
<td>Station fence, west</td>
<td>200</td>
<td></td>
<td></td>
<td>59.2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Station fence, south</td>
<td>200</td>
<td></td>
<td></td>
<td>54.8</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Station fence, east</td>
<td>200</td>
<td></td>
<td></td>
<td>50.8</td>
<td></td>
</tr>
</tbody>
</table>

*Adopted by GCS00-WGP-000-S-TRS-0002_00*

### Table 8-16  GCS01 operation noise at sensitive receptors (final development stage)

<table>
<thead>
<tr>
<th>s/n</th>
<th>Sensitive receptor</th>
<th>Approximate Distance (m)</th>
<th>Initial noise level at night time in dB(A)</th>
<th>Additional Noise level at night time in dB(A)</th>
<th>Total Noise level at night time in dB(A)</th>
<th>Increase of background noise in dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Krios (nearest outskirt of village)</td>
<td>1,950</td>
<td>28.2</td>
<td>26.1</td>
<td>30.3</td>
<td>2.1</td>
</tr>
<tr>
<td>2</td>
<td>Konstantinato (nearest outskirt of village)</td>
<td>2,050</td>
<td>28.2</td>
<td>25.6</td>
<td>30.1</td>
<td>1.9</td>
</tr>
<tr>
<td>3</td>
<td>Neochori (nearest outskirt of village)</td>
<td>2,350</td>
<td>28.2</td>
<td>24.7</td>
<td>29.8</td>
<td>1.6</td>
</tr>
<tr>
<td>4</td>
<td>Station fence, west</td>
<td>200</td>
<td></td>
<td></td>
<td>60.0</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Station fence, south</td>
<td>200</td>
<td></td>
<td></td>
<td>57.1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Station fence, east</td>
<td>200</td>
<td></td>
<td></td>
<td>54.2</td>
<td></td>
</tr>
</tbody>
</table>

*Adopted by GCS01-WGP-000-S-TRS-0001_00*

The modelled noise levels at the fence line of the plot are not expected to exceed the maximum noise limit of 65 dB(A) for areas with predominately industrial characteristics’ stipulated in Greek legislation (PD 1180/81), nor the 45 dB(A) limit during night time. Therefore, based on national

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8Based on the meeting held with the Ministry of Environment, Energy and Climate Change, Dept of Air Pollution and Noise Control, on 27.02.2013, these are the applicable noise limits. The Compressor Station itself is considered an industrial area and the surrounding area is of agricultural use, where no statutory noise limits exist. Consequently, the land use type of the area is ‘area with predominately industrial characteristics’.
legislation no additional mitigation measures are necessary. The estimated noise levels at receptors closest to GCS00 and to GCS01 are presented in Table 8-17. Impacts assessment is determined based on meeting the criteria of National Legislation (45 dB(A) during night time) in combination with the IFC criterion of 3 dB(A) increase of background noise level. If both requirements are met, the impact is deemed to be not significant. Since all the calculated night time noise levels are below the statutory limit of 45 dB(A), the impact was assessed based on the exceeding of the 3 dB(A) criterion.

### Table 8-17 Estimated Noise Levels to closest Receptors and Assessment of Impacts

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Approximate Distance (m)</th>
<th>Total Noise levels at night time in dB(A)</th>
<th>Increase of background noise in dB(A)</th>
<th>Impact Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GCS00 (10 bcm phase)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thymaria</td>
<td>2,650</td>
<td>29.9</td>
<td>0.5</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Tavri</td>
<td>2,900</td>
<td>30</td>
<td>0.6</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Peplos</td>
<td>1,650</td>
<td>30.9</td>
<td>1.5</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Kipoi</td>
<td>2,250</td>
<td>29.8</td>
<td>0.4</td>
<td>Not Significant</td>
</tr>
<tr>
<td><strong>GCS01 (20 bcm phase)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Krinos (nearest outskirt of village)</td>
<td>1,950</td>
<td>30.3</td>
<td>2.1</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Konstantinato (nearest outskirt of village)</td>
<td>2,050</td>
<td>30.1</td>
<td>1.9</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Neochori (nearest outskirt of village)</td>
<td>2,350</td>
<td>29.8</td>
<td>1.6</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

Compiled by: ASPROFOS (2013)

Regular operation will not produce abrupt noise emissions. However, a regular, one time per year event that will likely continue for half a day is the depressurisation of the station which will result in intermittent emission peaks of > 100 dB(A) at the noise source when gas is vented (via the 70 m high vent). Venting will also be necessary in the case of an emergency.

As previously discussed in Section 8.3.2.1, noise emitted at 100 dB(A) is perceived as 70 dB(A) at a distance of 32 m. Given the fact that the closest sensitive receptor is 1,950 m, the impact of such an event is deemed not significant. This is, also, supported by the German Noise Guideline (TA Lärm) which allows for such an event 70 dB(A) at day time and 55 dB(A) at night time measured at the nearest sensitive receptor (i.e. residential houses).
Due to the highest priority of environmental and safety aspects, noise emissions during emergency cases are not to be considered within this noise assessment. Nevertheless, noise emissions of emergency power generators (currently 2 are foreseen) and/or fire extinguisher pumps (currently 1 is foreseen) should be limited for the purpose of routinely necessary test runs. The sound power level of those diesel motor driven equipment items should therefore not exceed LWA = 95 dB(A) each.

8.3.3.2 Mitigation Measures

The mitigation measures embedded in the design of the compressor stations are specifically focused on noise control measures inside the GCS00 and GCS01 buildings and are related to the major noise emitting equipment. Based on the noise propagation models operational noise levels at GCS00 and GCS01 plot fence line are calculated to be within the statutory noise level standards determined by Greek legislation (PD 1180/81) of 65 dB(A). In addition, the 3 dB(A) criterion of IFC, for increase of background noise, is also met.

Vegetation planting in the fence line of the compressor stations is also applicable as a noise screening measure.

Noise monitoring will be performed at the compressor stations fence line according to national legislation and at the closest sensitive receptor, if required.

With regard to venting events and the noise nuisance that the local population will experience for approximately half a day, Community Liaison Officer Activities will be undertaken well ahead of the events to provide full information and awareness about venting events.

8.3.3.3 Residual Impacts

As calculated for the initial phase of the project, the residual noise at the sensitive receptors of GCS00 will be audible but will be below the levels recommended by the National Legislation and WHO standards to protect against sleep disturbance at night and to protect the majority of people from being moderately annoyed during the day. In addition, the increase of background noise
level is under 3 dB(A), the criterion set by IFC. Regarding residual noise at the sensitive receptors of GCS01 (for the final development phase of the project), both National Legislation standards and WHO standards are also met.

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measure to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| Noise emissions from GCS00 | • No further project design measures required  
• Vegetation planting in the fence line.  
• Notification of venting events through Community Liaison Officer | NOT SIGNIFICANT  
• Foreseen noise level at closest receptors <32.5 dB(A)  
• Foreseen background noise increase at closest receptors <3 dB(A) |
| Noise emissions from GCS01 | • No further project design measures required  
• Vegetation planting in the fence line.  
• Notification of venting events through Community Liaison Officer | NOT SIGNIFICANT  
• Foreseen noise level at closest receptors <32.5 dB(A)  
• Foreseen background noise increase at closest receptors <3 dB(A) |


8.3.4 Decommissioning Phase

8.3.4.1 Potential Impacts

As outlined in Section 8.1 it cannot be foreseen today which decommissioning approaches will be taken at the time of decommissioning, but TAP AG is committed that this will be state-of-the-art at the time when it occurs. It is expected that the similar equipment, machinery and vehicles will be used during Project decommissioning as used for Project construction and similar noise impacts will occur from relevant activities. Should the pipeline be removed, no blasting will occur during decommissioning.

8.3.4.2 Mitigation Measures

Due to the fact that decommissioning will take place after a number of decades a mapping of the existing acoustic environment is proposed, prior to determining any mitigation measures. The
mapping will highlight potentially affected sensitive receptors. In this way then special mitigation measures can be tailored according to the future baseline requirements.

8.3.4.3 Residual Impacts

The type of residual impacts from decommissioning will be similar to those at the construction phase, but they are anticipated to be of even lower magnitude.

8.3.5 Summary of Impacts on Acoustic Environment

*Construction and Pre-Commissioning Phase:*
Project construction may lead to local noise nuisances emanating from normal construction activities and machinery on those settlements located in the immediate vicinity (<200 m) of the construction sites. No significant impact (noise or vibration) is expected on residential properties from blasting, hammering and trenchless construction activities due to these activities occurring on relatively remote sections of the pipeline route. Suitable mitigation will be used at the few locations where households have been identified to be in proximity to these activities. Standard mitigation measures, such as limiting construction activities to daytime hours, will also be applied in general.

*Operation and Maintenance Phase:*
During Project operations no significant impacts due to noise are anticipated by the operation of GCS00 or GCS01. For both sites, operational noise levels are lay within the Greek statutory limits. Both of the sites’ operation would not result in an increase of background noise level of more than 3 dB(A) which is set as a limit by IFC.

Scheduled maintenance operations will be notified to the sensitive receptors in order to mitigate the effect of very short significant high noise levels.

*Decommissioning Phase:*
Project decommissioning may lead to similar minor noise nuisances as the ones generated by the project’s construction. Currently, it can be said that the same mitigation measures used
During the construction phase will be applied during decommissioning. It is not possible to foresee which decommissioning approach will be taken at the time of decommissioning, but TAP AG will use the best industry practices available at the time when it occurs.

8.4 Water Resources (Groundwater and Surface Water)

8.4.1 Overview

During the development of the pipeline route, the Project has sought to avoid, minimise and mitigate impacts on water resources (in line with EU Water Framework Directive 2000/60/EC as amended by 2008/105/EC, and Groundwater Directive 2006/118/EC) through the options appraisal, route-refinement and final assessment. The ecological condition of rivers is included, in Section 8.8 Freshwater Ecology.

Box 8-3 presents the key sources of impact, potentially impacted resources and receptors, the baseline and Project influencing factors associated with the TAP Project on water resources (including surface water and groundwater).

Box 8-3 Key Considerations for Assessment – Water Resources

Sources of Impacts/ Risks

- Construction Phase: Preparation, construction and operation of temporary facilities (construction camps, pipeyards, water network etc.); Dewatering; Watercourse crossings; Erosion control; Hydrotesting (water abstraction and discharge); Site preparation and installation of GCS00 and GCS01; Movement of vehicles, equipment and personnel; Upgrade of existing access roads; Working strip preparation, trenching, lowering and laying of pipeline; Construction waste management and storage and handling of fuels and chemicals.
- Operation and maintenance phase: Production and disposal of solid and liquid wastes (i.e. at compressor stations); Use of water and raw materials; Maintenance of the pipeline.
- Decommissioning phase: Demobilization and abandonment of facilities and infrastructures.

Potentially Impacted Resources and Receptors

- Freshwater resources: surface water and groundwater

Particular Baseline Conditions that are Potentially Influencing Impact/ Risks

- Crossing points between pipeline and surface water bodies
- Quality and quantity of water resources
- Use of groundwater and surface water as a source of potable water
- Karst areas, areas where shallow groundwater is expected
Project Factors that are Potentially Influencing Impacts/ Risks

- Specific techniques used for hydrotesting water management, river crossings (trenchless technique - e.g. HDD) at the crossings of Rivers Evros, Filouri, Xiropotamos, Nestos, Aggitis, Strymonas, Axios, Vardarosasi, Grammatiko Greek and Aliakmonas), construction camp management, waste management, and traffic management

References

- Baseline is found in Section 6.2.3, 6.2.4 and 6.2.5. Impact Assessment Criteria is found in Annex 5.3. Monitoring Measures are described in Section 9.2.


Table 8-19 presents the key potential impacts of the TAP Project on water resources during the key Project phases.

Table 8-19 Key Potential Impacts – Freshwater Resources

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Restriction of future irrigation networks</td>
<td>Accidental pollution of freshwater resources by solid, liquid wastes and hydrocarbon/fuels</td>
</tr>
<tr>
<td></td>
<td>Consumption of freshwater resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accidental pollution of freshwater resources by solid, liquid wastes and hydrocarbons/fuels</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Erosion control</td>
<td></td>
</tr>
<tr>
<td>Modification of watercourse morphology increasing flooding and disturbing drainage networks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effects on surface water from sediment plumes caused by watercourse crossings, trenching, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption of freshwater resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accidental pollution of freshwater resources by solid, liquid wastes and hydrocarbons/fuels</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ERM (2012)

Each key potential impact is discussed in the following Sections, providing information on how each source is likely to have an impact on receptors and the mitigation measures incorporated within the Project.
8.4.2 Construction and Pre-commissioning Phase

8.4.2.1 Potential Impacts

8.4.2.1.1 Watercourse crossings

The proposed pipeline route crosses 16 rivers, 34 streams and 564 irrigation channels (described in Section 6.2.5). Two main methods will be applied to construct: open cut and trenchless. Although the chosen method will depend upon the individual characteristics of the watercourses concerned with a view to minimize any impacts, the open cut method is the preferred option (especially for small streams, creeks and channels). Use of trenchless techniques will be applied when the geology and geomorphology of the crossing site allows for it and the presence also of sensitive downstream receptors.

- Open cut methods require an open trench through the watercourse (see Table 8-14). The surface (river or stream bed) is then reinstated close to its original condition after the trench is backfilled. A principal drawback of the open-cut technique is that in aquatic systems, open cut trenching can generate a pulse of suspended sediment which can reach values that may be several magnitudes higher than background concentrations. The flumed and the dam and pump methods are usually less intrusive regarding high sediment concentrations.

- Trenchless crossings, mainly HDD is an alternative technology used for inserting pipelines under sensitive areas or infrastructure without directly impacting on the watercourse. Geotechnical investigations are needed to confirm whether the HDD method is a viable river crossing method. Typically HDD provides a stable and virtually maintenance-free crossing method with minimal to no disturbance of the stream or river bed. However, as drilling fluids are used during HDD, there is a risk of spillage and therefore subsequent impacts to surface and groundwater.
### Table 8-20 Crossing Methods and Environmental Considerations

<table>
<thead>
<tr>
<th>Method</th>
<th>Technical description</th>
<th>Environmental considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open-cut</td>
<td>• Trench excavated and back-filled without diversion of flow.</td>
<td>• High sediment entrainment and deposition</td>
</tr>
<tr>
<td></td>
<td>• Equipment typically operates from each bank with spoil stored at upland locations.</td>
<td>• Minimal period of in-stream activity</td>
</tr>
<tr>
<td></td>
<td>• Large watercourses may require in-stream equipment and spoil storage.</td>
<td></td>
</tr>
<tr>
<td>Flumed</td>
<td>• Dams isolate the instream flumed area and flow is diverted through a pipe (flume)</td>
<td>• Low sediment entrainment restricted to the installation and removal of dams and flumes</td>
</tr>
<tr>
<td></td>
<td>• Turbid ditch water pumped to upland sumps</td>
<td>• Effectiveness dependent on proper materials and application</td>
</tr>
<tr>
<td></td>
<td>• Best suited for watercourses with flows &lt;1 m³/s, for larger watercourses (&lt; 6 m³/s) super flume is suitable</td>
<td>• Longer period of instream activity than open – cut crossings</td>
</tr>
<tr>
<td>Dam and pump</td>
<td>• Dams isolate the in stream work area and bypass pumps maintain downstream stream flow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• turbid ditch water pumped to upland sumps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• best suited for watercourses with flows &lt; 1 m³/sec, non-permeable substrates and well-defined banks</td>
<td></td>
</tr>
<tr>
<td>Horizontal Directional Drilling (HDD)</td>
<td>• A trenchless crossing method. The HDD process begins with boring a small diameter, horizontal hole (pilot hole) under the crossing obstacle (e.g. a river) with a continuous string of steel drill rod. When the bore head and rod emerge on the opposite side of the crossing, a special cutter, called a back reamer, is attached and pulled back through the pilot hole. The reamer bores out the pilot hole so that the pipe can be pulled through. The pipe is usually pulled through from the side of the crossing opposite the drill rig.</td>
<td>• Additional space requirements in order to facilitate rig sites that will accommodate HDD related equipment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Special containment and storage of used drilling mud (bentonite) before final disposal. Disposal through licenced contractors.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Usually a drilling mud, such as fluid bentonite clay, is forced down the hole to stabilize the hole and remove soil cuttings. Occasionally leaks of drilling mud may occur.</td>
</tr>
</tbody>
</table>

ERM (2012)

In general, the open-cut method, when combined with the appropriate scheduling of the works (during low water volume periods) and diversion of water flow during the works (upstream and downstream damming and the over-pumping of waters, or the installation of flume pipes if the channels are sufficiently narrow), will generate impacts of small magnitude related to water turbidity and chemical characteristics or changes to river bed morphology. The application of the method to rivers, streams or irrigation channels of low to medium sensitivity or value will typically lead to impacts of minor significance.

---

9 2 m x 3 m x 32 m
Rivers of high ecological value or sensitivity, such as the Rivers Evros, Filiouris, Xiropotamos, Nestos, Aggitis, Strymonas, Axios, Vardarovasi, Grammatiko Creek and Aliakmonas, will be crossed using trenchless technique. Typically trenchless crossings (e.g. HDD) provides stables and virtually maintenance-free crossing methods with minimal to no disturbance of the stream or river bed. Geotechnical investigations are needed to confirm if HDD method is possible be applied as river crossing method. The presence of sensitive downstream receptor influenced also the decision on whether trenchless crossing methods are considered. For any drilling fluids, that will be used, measures will be adopted to maintain plant and appropriately handle and dispose of spent fluids and cuttings. As a result, under normal HDD execution the magnitude of impacts is considered negligible and therefore no significant impacts to surface or groundwater quality are anticipated to result. However there is a small probability of a betonite leak which may have a temporary impact on water quality.

8.4.2.1.2 Trenching

Potential impacts to surface waters may result from trenching activities (outside the watercourse), due to the following.

- Topsoil and other earth materials will be stripped from the construction working area and stored to one side. These may become entrained by rainwater during heavy rainfall, and subsequently increase the turbidity of neighbouring streams and eventually the major watercourses along the pipeline route. Without the implementation of good practice mitigation measures, during times of heavy rainfall, depending on the vicinity to a watercourse (with flow) potential impacts of moderate significance could occur to surface water quality. This is judged based on the relatively localised nature of the impact, but considering the significant degree of change that sediment will make to a surface water body and the potential secondary impacts that this will have to aquatic life.

- In some wet areas or areas of high water table, it will be necessary to dewater the trench. De-watering allows safe construction by preventing trench collapse and allowing trench bottom (bedding) inspection prior to lowering in. It also prevents the trench from containing fine sediments which may alter the subsequent permeability and natural drainage of the soil. During dewatering, the ground water table is lowered. The process of dewatering is continued until construction is completed and the pipeline trench has been backfilled. The groundwater removed will then be discharged into available ditches, irrigation channels,
watercourses, rivers (sloping away from dewatering area) or to pre-agreed areas of land with permission of the relevant Authority.

Table 8-21 summarises the findings of the potentially shallow groundwater areas based on current baseline data (see Section 6.2.3).

Table 8-21  Sections of the pipeline route where dewatering is anticipated

<table>
<thead>
<tr>
<th>Route section</th>
<th>Chainage (KP)</th>
<th>Total length (km)</th>
<th>Potential for groundwater vulnerable areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Evros</td>
<td>0-3.5</td>
<td>3.5</td>
<td>High - Vulnerability depends on soil cover</td>
</tr>
<tr>
<td>Southern Evros</td>
<td>12-15</td>
<td>12</td>
<td>High - Vulnerability depends on soil cover</td>
</tr>
<tr>
<td></td>
<td>32-36</td>
<td></td>
<td>High - Vulnerability depends on soil cover</td>
</tr>
<tr>
<td></td>
<td>39-44</td>
<td></td>
<td>High - Vulnerability depends on soil cover</td>
</tr>
<tr>
<td>Lowlands of Evros</td>
<td>77-87</td>
<td>10</td>
<td>High - Vulnerability depends on soil cover</td>
</tr>
<tr>
<td>Komotini-Xanthi</td>
<td>81.0-81.7</td>
<td>17.8</td>
<td>High - Vulnerability depends on soil cover</td>
</tr>
<tr>
<td>Plain*</td>
<td>98.0-99.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>103.0-105.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>112.0-113.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>116.0-120.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>135.1-136.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>140.0-146.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filippoi Plain</td>
<td>210-225</td>
<td>15</td>
<td>High - Vulnerability depends on soil cover</td>
</tr>
<tr>
<td>Serres Plain</td>
<td>238-242</td>
<td>9.8</td>
<td>High - Vulnerability depends on soil cover</td>
</tr>
<tr>
<td></td>
<td>264.0-265.0*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>281.0-281.8*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>290-294</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gallikos Plain</td>
<td>356-360.5*</td>
<td>4.5</td>
<td>High - Vulnerability depends on soil cover</td>
</tr>
<tr>
<td>Axios Plain</td>
<td>371.3-394</td>
<td>28.7</td>
<td>High - Vulnerability depends on soil cover</td>
</tr>
<tr>
<td></td>
<td>397-400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mt Askion slopes</td>
<td>484-489</td>
<td>23</td>
<td>High - Vulnerability depends on soil cover</td>
</tr>
<tr>
<td></td>
<td>498-507</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kastoria to border</td>
<td>507-533</td>
<td>26</td>
<td>High - Vulnerability depends on soil cover</td>
</tr>
</tbody>
</table>

* Data available from previous projects


Drawdown of groundwater is expected to be localised and levels will normalise rapidly on cessation of pumping. The consequences of the dewatering to groundwater availability are dependent on the type of the aquifer and its hydraulic property. However, due to the limited time of dewatering, these are considered minimal. Dewatering will also have minimal consequences to
groundwater quality. Therefore, the significance of the impact to groundwater is considered minor. Secondary impacts to surface water quality associated with the discharge of waters (from dewatering or run-off or erosion from dewatering) could occur due to sediment content or historic contamination. However given the nature of the land within the working corridor it is unlikely that any existing contamination will be encountered. Therefore, due to the low likelihood of existing contamination, **minor** significant impacts are predicted.

8.4.2.1.3 Hydrotesting

A hydrostatic pressure test will be performed on the pipeline after installation. This procedure involves filling the pipeline with water, pressure testing the pipeline to ensure integrity and subsequently discharging the water. Hydrotesting will require water abstraction from local water sources. The water used will generally be collected and reused in subsequent pipeline sections. The water bodies alongside the route are the water sources for the hydrostatic testing. After its use the water will be discharged to local watercourses. An aspect of hydrotesting is that the volume of water discharged from each section may have physical impacts on the receiving waters. General the discharge rate after finalization of hydrotest will follow the same rules as applicable for abstraction. The discharge rate into watercourse shall be adjusted to the respective size and type of water body in order to avoid an artificial flooding, morphological impact to river bed. The presented hydrostatic testing concept is focused on the re use of fresh water. After successful testing of one or more sections the water will be drained into the adjacent test section(s).

The advantages are various:

- The total amount of water which needs to be withdrawal from the water source is reduced.
- The number of Test Heads to be provided by the construction contractor can be reduced to 60 – 70%.
- The time duration for stabilisation will be shorter.
- The hydrostatic head can be reduced during the filling operation. (More safe operation).
Abstraction, reuse, monitoring of water quality and eventual discharge of hydrotesting water will be the responsibility of the contractor, who will also obtain the required permits from the Decentralised Administration Authorities (as applicable).

General, the hydrotesting water will be free of any chemicals or oxidizers. Before discharging the water to the river it will pass a sedimentation pond in order to allow for separation of any solid.

In some cases the pipeline may be protected from chemical and microbiological damage by the use of oxygen scavengers, corrosion inhibitors or biocides during hydrostatic testing. These may have a toxicological impact on the area receiving the discharge.

Both water abstraction and discharge can be associated with significant impacts, i.e. depletion of water resources, water pollution, soil erosion, etc., if not carried out in an environmentally conscious way. Prior to the application of mitigation these impacts are anticipated to be of moderate significance to the associated watercourse given the possible changes that could occur to channel morphology following discharge and the potential for pollution from chemical substance.

8.4.2.1.4 Construction Sites and Temporary Facilities

Construction sites and temporary facilities are typically areas where machinery are stored and where oil residues, sanitary effluents and solid waste may be generated. Improper management of such waste streams may be associated with impacts of major significance if they find their way into surface waters or groundwater. Receptors of high sensitivity comprise the high water table areas mentioned earlier. Also deep groundwater within karstified aquifers crossed by the pipeline could be considered as a potential receptor. This is because groundwater in karst is very vulnerable especially if thick soil horizons are absent. More information can be found in Annex 6.6.2.
8.4.2.1.5 Consumption of Freshwater Resources

Freshwater will be required for:

- Use during construction activities, for reducing dust emissions (mitigation measure), domestic water consumption etc., and
- Hydrotesting for pipelines and equipment. The hydrostatic testing of pipelines involves pressure testing with water to detect leaks and verify equipment and pipeline integrity. Water will be extracted from the large rivers along the route.

Hydrotesting may be related to impacts of medium to large magnitude given the high volumes of water required (approximately total volume of 550,000 m³) despite the fact that the water will be discharged back after its use. Careful selection of the abstraction points has been made (see Section 4.4.4.2) in order to ensure low sensitivity of the receptors in terms of water availability. Overall impact significance is considered minor to moderate.

8.4.2.1.6 Accidental Pollution of Water Resources by Solid and Liquid Wastes

Accidental pollution of water resources by solid, liquid wastes and accidental spill of hydrocarbon/fuels, can occur through the following construction activities:

- Production and disposal of solid and liquid wastes. Wastes generated during construction are classified into the following four categories: inert (without risk of pollution), domestic (to be transported to a controlled municipal waste disposal site), oily and hazardous (to be segregated for collection and disposal by specialist contractors), and liquids (“black” and “grey” water from construction and operation camps, rainwater from sealed surfaces and roofs);
- Storage and handling of fuels and chemicals, to be used for construction machinery. Accidental spills from vehicles, storage tanks and chemical stores, metalworking and welding can pollute water resources.
8.4.2.2 Mitigation Measures

8.4.2.2.1 Watercourse Crossings

- A Water Course Crossing Plan will be established for each crossing and include specifications for minimising sediment dispersion and impacts on river ecology including banks and riverine habitats.

- Horizontal directional drilling is being investigated, as a trenchless crossing technique, for the crossings of the Rivers Evros, Filouri, Xiropotamos, Nestos, Aggitis, Strymonas, Axios, Vardaravasi, Grammatiko Creek and Aliakmonas to minimise potential impacts. During HDD application, special measures for the containment and disposal of cuttings and bentonite fluid will be affected. Crossing of remaining minor watercourses will be undertaken by open cut techniques using methods such as flume pipes (as appropriate) to allow continual flow.

- When using open cut techniques, locally appropriate materials will be used for reinstatement. The preference will be to carefully remove the materials so that they may be reinstated at the same location.

- Vehicles will be prohibited from driving through watercourses. Portable bridges may be used in order to avoid this contact between vehicles and machinery and surface waters;

- Mitigation measures to be applied in high sensitivity areas along the study area are presented below:
  - Maximum speed allowed to vehicles will be 20 km/h in the proximity (100 m) of any surface waters;
  - Wherever possible machinery will avoid being in contact with surface waters;
  - Inspect all machinery for leaks prior to mobilisation to watercourse crossing.
  - During river crossing with open cut method safety distances for machines, top soil piles from riverbanks will be applied.
  - Access roads located in the proximity of surface water and also the installation of adequate erosion and sediment control/drainage, will be paved, or in the absence of being paved they will be irrigated periodically; and
  - Excavated topsoil, subsoil stockpiled and erosion control for topsoil/subsoil stockpiles, will be irrigated periodically.
8.4.2.2.2 Trenching

- Water Management Plan will be established to identify and manage groundwater pumping needs and to manage surface run-off.

- Discharged waters from dewatering activities, if returned to streams or rivers will be discharged in a way that will minimise physical impacts to channel morphology, i.e. without any turbulent flows and with sediment levels below receiving waters.

- Careful management and control of the groundwater table via monitoring holes will be implemented in cases where dewatering is necessary to ensure the required water reduction level is achieved. The discharge of the water will be undertaken in full cognisance of permits and notifications by water authorities/land owners.

- Measures will be employed to intercept run-off from the working corridor, by using sandbags and settlement tanks or lagoons, to reduce the suspended sediment load of the water prior to its discharge into watercourses. Alternatively, the water may be filtered through a suitable membrane such as a geotextile material to clean the water prior to discharge. In order to trap any sediment that is released into the watercourse, filters such as straw bales or ‘sedimats’ or silt fences will be positioned around dewatering points to act as a filter.

- Full reinstatement will take place of land drainage features disturbed during construction.

- The length of working area open at any one time will be a maximum of 30 km.

- Discharges will not be made without prior agreement and appropriate consents and approvals from the authorities.

- Vehicles will be prohibited from driving through watercourses.

- Where appropriate, prior to construction, header drains will be installed to connect in all existing viable field drains on the high side of the working width. This will ensure continuity in the functioning of the existing field drainage. General field drains present along the route.

- Cut off ditches will be employed to prevent water from entering excavations.

- A condition survey will be carried out to assess field drains within the 38 m working strip. This will enable an assessment to be made of any damage created during construction and for reinstatement (such as additional or replacement field drains) to be targeted appropriately.
8.4.2.2.3 Hydrotesting

- Where practicable water will be reused in subsequent sections in order to minimise fresh water abstraction needs.
- Prior to discharge, water will be tested to ensure that its quality complies with local and international requirements for wastewater discharge. Local treatment (i.e. filtration) will be provided if necessary.
- After treatment, discharge of any waters will be carried out so as to minimise physical impacts on receptor morphology.
- Discharges will not be made without prior agreement and appropriate consents and approvals from the authorities.

8.4.2.2.4 Consumption of Freshwater Resources

- Surface water sources with the greatest amounts of water flux have been considered for hydrotest water abstraction.
- Avoid any spill of water through valves, joints or pipes.
- Periodic checks should be undertaken and an immediate response should be provided in the case that any spill or leak is detected.
- Minimize water consumption as much as possible, by training the workers in personal minimization and recycling practices (such as not allowing water to flow whilst not in use, not throwing water away but where possible storing it for re-use, etc.).
- Minimize water consumption related to construction activities.
- A Water Management Plan will be developed in order to detail measures to be applied that minimize the consumption of water along the Construction and Pre-commissioning phase.

8.4.2.2.5 Accidental pollution of water resources by solid and liquid wastes

General mitigation measures will include:

- Implementation of the ESMMP and topical sub-plans according to international best practice;
• Development of a Waste Management Plan (see Section 9.3) to avoid solid or liquid waste discharges to water bodies; and

• Development of a Hazardous Materials Management Procedure (see Section 9.3) in order to detail procedures for working with chemical products.

• Develop a Spill Prevention and Response Plan (see Section 9.3) to avoid and react on any pollution of water bodies that may accidently occur as a result of hydrocarbon/fuels spills.

Specific mitigation measures at construction camps will include:

• All areas for which there is a risk of leaks or spills during plant and vehicle storage, maintenance or refuelling, and areas where materials with polluting potential will be stored will be bunded. Bunded areas will be designed to contain at least a 110% of the largest storage tank plus 10% of the aggregate volume of all storage tanks within the bunded area.

• Hazardous substances will be stored within impermeable bunded areas to protect groundwater from pollution by accidental spills.

• In any areas with vulnerable groundwater resources hard core will be upgraded to hardstanding for use at temporary facilities to prevent accidental pollution of groundwater.

8.4.2.3 Residual Impacts

8.4.2.3.1 Watercourse crossings

The application of a trenchless method to cross the Rivers Evros, Filiouris, Xiropotamos, Nestos, Aggitis, Strymonas, Axios, Vardarovasi and Grammatiko Creek and Aliakmonas will ensure that residual impacts to water quality or river bed morphology will be Not Significant. The existing experience in Greece (crossing of river Nestos by the gas pipeline) verifies this expectation.

Residual impacts of Minor significance are anticipated to the crossing of any other smaller rivers and streams, which are mostly of seasonal and ephemeral flow.
8.4.2.3.2 Trenching

With the length of the working corridor to be open at any time to be minimised, and sections taking approximately 3 months to complete (including reinstatement), this will minimise soil storage time and potential impacts to surface watercourses from run-off from the construction working corridor. The application of measures to intercept and treat run-off from the construction working area for example by using sandbags will also minimise the probability and magnitude of any impacts. As a result no significant residual impacts are anticipated to occur to surface water quality from run-off.

With the monitoring of groundwater level during dewatering activities the residual impacts will be reduced to be of minor significance to the areas with shallow groundwater. Impacts to surface water quality as a result of the discharge of water from dewatering activities will be reduced to be minor given that all discharges will be intercepted and treated prior to entering a watercourse.

8.4.2.3.3 Hydrotesting

The discharge of hydrotest waters will be designed, in consultation with local authorities to ensure that mechanical damage to the receiving water body does not occur. The Contractor will also not use any additives which will reduce the likelihood of pollution to surface water quality. Given the application of these measures, residual impacts are anticipated to be of minor significance.

8.4.2.3.4 Construction Sites

The implementation of the above-mentioned mitigation measures as well as of sound engineering practices at the construction sites will reduce the significance of potential impacts be of minor significance.
8.4.2.3.5 Consumption of Freshwater Resources

The proposed mitigation measures will reduce the amount of freshwater used for the Project. The magnitude of the impact is defined as small so the significance of the impact is considered not significant.

8.4.2.3.6 Accidental Pollution of Freshwater Resources by Solid and Liquid Wastes

The proposed mitigation measures will reduce the amount of freshwater used in the project, which should be applied along the whole project area and the accidental pollution by solid and liquid wastes. The magnitude of the impact is defined as small so the significance of the impact is considered not significant.

8.4.2.3.7 Summary of Residual Impact Significance

The Table 8-22 presents a summary of the significance of the residual impacts on water resources during the construction phase:

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction and Pre-commissioning Phase</td>
<td>• Trenchless crossing (e.g. HDD) at the Rivers Evros, Filiouris, Xiropotamos, Nestos, Aggitis, Strymonas, Axios, Vardarovasi, Grammatiko Creek and Aliakmonas</td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>• Open cut techniques for the other crossings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Application of watercourse crossing plan and Prohibition of vehicles to drive through watercourses</td>
<td></td>
</tr>
<tr>
<td>Watercourse Crossings</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Minor significance residual impacts to rivers or streams crossed by the open cut technique</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• No significant residual impacts to Rivers Evros, Filiouris, Xiropotamos, Nestos, Aggitis, Strymonas, Axios, Vardarovasi, Grammatiko Creek and Aliakmonas due to the trenchless crossing (e.g. HDD) method.</td>
<td></td>
</tr>
<tr>
<td>Trenching activities</td>
<td>Hydrotesting</td>
<td>Construction sites</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>- Minimal modification of channel morphology</td>
<td>- Where practicable water will be reused in subsequent sections</td>
<td>- All areas for which there is a risk of leaks or spills will be banded</td>
</tr>
<tr>
<td>- Careful management and control of the groundwater table via monitoring holes</td>
<td>- Water will be tested prior to discharge and local treatment will be provided if necessary.</td>
<td>- Where necessary hard core will be upgraded to hard standing for use at temporary facilities to prevent accidental pollution of groundwater</td>
</tr>
<tr>
<td>- Intervention of run-off from the working corridor</td>
<td>- Minimisation of physical impacts on receptor morphology</td>
<td>- Sound engineering practices at the construction sites</td>
</tr>
<tr>
<td>- Full reinstatement of land drainage features</td>
<td>- Discharges will not be made without prior agreement and appropriate consents and approvals from the authorities</td>
<td>- Prompt installation of erosion control and reinstatement.</td>
</tr>
<tr>
<td>- Specific length of working area open at any one time.</td>
<td>- In special cases additives will be used</td>
<td></td>
</tr>
<tr>
<td>- Vehicles will be prohibited from driving through watercourses.</td>
<td>- A Hydrotesting Plan will be prepared</td>
<td></td>
</tr>
<tr>
<td>- Header drains and cut off ditches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Condition survey</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- A Water Management Plan will be prepared</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MINOR**
- Minor significance residual impacts to the areas with shallow groundwater. No significant residual impacts are anticipated to occur to surface water quality

**MINOR**
- Minor significance residual impacts are anticipated

**MINOR**
- Minor significance residual impacts are anticipated

**NOT SIGNIFICANT**
- Maximum abstraction from surface watercourses appropriately limited.
- Only low sensitivity groundwater will be considered as a potential source of water

**NOT SIGNIFICANT**

Source: ERM (2012), EXERGIA &ASPROFOS (2013)
8.4.3 Operation and Maintenance Phase

8.4.3.1 Potential Impacts

8.4.3.1.1 Future Irrigation Networks

This potential impact is associated with the existence of the pipeline as it may eventually affect the construction of new irrigation networks. The pipeline will be buried at a depth of about 1 m and any subsequent excavation works above it will be almost prohibited. Nevertheless, the issue is clearly of technical nature and it is considered that alternatives to crossing the pipeline route will be developed. In case that no other alternative exists, a special study for the crossing will be required.

8.4.3.1.2 Disturbance of Drainage Networks

Given that most of the drainage networks are constructed at depths of 0.7 to 0.9 m, it is expected that such networks could be constructed without problems after the pipeline is in place and in operation. As a precaution, the trenching of the drainage networks in the crossing area should not be carried out by mechanical means.

8.4.3.1.3 Consumption of Freshwater Resources

The main water consumption during the Operation phase is the use of water for operation of the compressor stations such as service water systems and domestic water supply. There is potentially a significant water requirement for the operation of the compressor stations.

8.4.3.1.4 Accidental Pollution of Water Resources

Solid and liquid wastes generated by the Project can accidentally pollute water resources, affecting resource quality. The main sources that may generate pollution of freshwater resources are:
- Production and disposal of solid and liquid wastes. During the operations phase only limited amounts of waste are envisaged, due mainly to maintenance activities in the compressor station and block valve stations. The following types of waste water have been taken into consideration: rain water, sanitary sewer from installations within buildings and oily water. The oily water is surface water from areas which may be polluted in case of leakages; and

- Storage and handling of fuels and chemicals.

8.4.3.2 Mitigation Measures

The impacts to irrigated areas will be addressed by the appropriate scheduling of the construction of future irrigation network. In this case, the following measures are proposed:

- The construction of new irrigation channel over the pipeline should be avoided.
- Every new irrigation network near to pipeline should be constructed in accordance to Owner instructions.
- When irrigation is provided by wells and the water is supplied to pipe network, care will be taken to replace the piping removed from the construction zone by plastic or elastic hoses, prior to final restoration.

8.4.3.3 Residual Impacts

Normal Project operation is not associated with any significant residual impacts to surface waters or groundwater. Specifically, all necessary measures have been taken during the design of the Project, for the following:

- The avoidance of any leakage from pipeline joins (hydraulic testing, non-destructive inspection of all joins, etc.).
- The full protection of the pipeline from corrosion.
- The application of control measures for the operational characteristics of the pipeline after installation.
- The treatment of all operational discharges to local and international standards.
Table 8-23  Residual Impacts - Freshwater Resources – Operations Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Future irrigation networks</td>
<td>• Appropriate scheduling of the construction works.</td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>• Notification of the Landowner to TAP Company</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Construction of new irrigation network near the pipeline in accordance of Owner instructions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Care for the replacement of the piping removed from the construction zone.</td>
<td></td>
</tr>
<tr>
<td>Consumption of freshwater resources</td>
<td>• Avoidance of any spill of water through valves, joints or pipes</td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td></td>
<td>• Monitoring of spills or leaks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Minimization of water consumption by the workers</td>
<td></td>
</tr>
<tr>
<td>Accidental pollution of freshwater resources</td>
<td>• Operation under international standards ESMMP</td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td></td>
<td>• Waste Management Plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hazardous Materials Management Procedure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Spill Prevention and Response Plan</td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012)

8.4.4 Decommissioning Phase

As outlined in Section 8.1 it cannot be foreseen today which decommissioning approaches will be taken at the time of decommissioning, but TAP AG is committed that this will be state-of-the-art at the time when it occurs. It is expected that the similar equipment, machinery and vehicles will be used during Project decommissioning as used for Project construction and similar impacts will occur from relevant activities. The related impacts on freshwater resources will be not significant.

8.4.5 Summary of Impacts on Water Resources

Construction and Pre-Commissioning Phase:

The main, direct impacts on surface waters result from watercourses crossings. It is foreseen that the Rivers Evros, Filiouris, Xiropotamos, Nestos, Aggitis, Strymonas, Axios, Vardarovasi and Grammatiko Creek and Aliakmonas will be crossed utilising a trenchless method, while the other crossings are under study and will be subject to geo-technical feasibility. On the smaller water courses the dry open cut method will be used during periods of low flow and technical measures
implemented to minimise sediment dispersion. A Watercourse Crossing Plan will be established for each crossing and include specifications for minimising sediment dispersion and impacts on river ecology including banks and riverine habitats.

The route crosses some sections where high groundwater tables will likely be encountered.

A Water Management Plan will be established to identify and manage groundwater pumping needs and to manage surface run-off. Excessive groundwater pumping for dewatering of the trench during construction will be avoided as needed by state-of-the-art technical measures e.g. pumped groundwater will be re-infiltrated by infiltration galleries in the vicinity. This together with the fact that the trench will be open only for a short time, technical measures will prevent impacts on vegetation that is dependent high ground water level, drying up of soils and avoid short term fluctuation in shallow groundwater that may affect archaeological heritage or foundation of buildings.

Large pipeline construction sites have the potential for uncontrolled site run-off and accidental spills of fuels, lubricants and other water polluting substances. Such potential sources of impact can be largely avoided by site run-off management, wastewater treatment, waste management, proper storage and storage of water endangering substances, i.e. good housekeeping practice construction management by the EPC contractor. A Spill Contingency Plan to respond to any spill or unintentional discharge of untreated wastewater or waste will be set-up. Special caution to prevent silting or spills will be required near locations where the shallow aquifer or surface water is used for local water supplies.

During construction, the largest quantities of fresh water (approximate a total of 550,000 m³) will be required for hydrotesting. Additional water will be needed for consumption at construction camps and localised dust suppression.

Based on the Hydrostatic Testing Concept a detailed Hydrotesting Plan will be developed by TAP AG which will include mitigations measures identified in the impact assessment. These include: the recycling of hydrotesting water to the extent possible in the subsequent sections of the pipeline; the maximum water abstraction limits will be agreed with the relevant authorities through the appropriate permitting system: discharging of used hydrotest water will be with prior settling
of suspended solids, and in a way that no channel erosion at river bed or its banks will occur and peak floods are avoided.

**Operation and Maintenance Phase:**
The presence of the pipeline could affect the development of future irrigation networks as it crosses large agricultural areas, which will require specific technical studies for their development.

Water consumption during operations is considered insignificant and connected only to domestic use. Therefore no conflict with water use for irrigation, public water supply or similar is anticipated. Storm water run-off from the compressor station sites will be collected and sent via sediment traps and oil separators before discharge.

The potential for accidental spills of polluting substances (i.e. fuel, lubricants) is unlikely as no regular handling of large quantities of such substances is foreseen and proper storage and housekeeping of lubricants, cleaning agents etc. will reduce the risks. Sanitary waste water from the compressor station will be treated by compact treatment plants.

**Decommissioning Phase:**
During Decommissioning Phase, the mitigation measures and the respective residual impacts will be similar to those in Construction and Pre-Commissioning Phase associated to movement of vehicles, equipment and personnel, use of water and production and disposal of solid and liquid wastes. These sources of impact may be present in block valve stations and compressor stations also.

### 8.5 Subsurface and Soil

#### 8.5.1 Overview

Pipeline construction will result in disturbance of existing soils in the standard 38 metres (m) wide working strip along the approximately 543 km long route between the Greek – Turkish border and the Greek/ Albanian border (total ~ 2,063.4 ha). According to the following table, a further 101 ha will be temporarily disturbed by the establishment of the 8 pipeline construction camps, 2
compressor station construction camps and 17 pipe yards that are currently envisaged in the design of the Project. Approximately 18 ha of soil will be permanently lost by surface sealing at the compressor stations GCS00 and GCS01 and the 22 BVS.

Table 8-24 Land Take of the Project During Construction

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Temporary Land Take</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline (~543 km) Working Strip</td>
<td>Max. 38 m working strip → 20,634,000 m² (2,063.4 ha)</td>
</tr>
<tr>
<td>Access Roads</td>
<td>29.6 km upgraded → 266,400 m² (27 ha)</td>
</tr>
<tr>
<td>(Upgrade 29.6km, 9m width)</td>
<td></td>
</tr>
<tr>
<td>[Note: no new roads required]</td>
<td></td>
</tr>
<tr>
<td>Compressor Station Site (including safety stand-off)</td>
<td>360,000m² (36 ha)</td>
</tr>
<tr>
<td>Block Valve Stations (about 22)</td>
<td>18m x 39m = 702m² fenced area each (15,450 m² or ~1.55 ha in total)</td>
</tr>
<tr>
<td>Construction Camps (8)</td>
<td>50,000m² per camp (400,000 m² or 40 ha in total)</td>
</tr>
<tr>
<td>Pipe Yards (17)</td>
<td>544,000m² in total (54.4 ha)</td>
</tr>
<tr>
<td>River crossing</td>
<td>n/a (case by case)</td>
</tr>
<tr>
<td>Road crossing</td>
<td>n/a (case by case)</td>
</tr>
</tbody>
</table>

Source: GPL00-ILF-100-F-TRP-0003_00---TAP-FEED-GR-PLN-REP-1575--APPENDIX 3 - Comparison of Logistic Concepts – Greece (05-04-2012)

Box 8-4 presents an overview of the key sources of impact, potentially impacted resources and receptors, and baseline and Project influencing factors associated with this resource.

Box 8-4 Key Considerations for Assessment - Subsurface and Soil

Sources of Impact/Risk

- **Construction Phase**: Set-up (including site preparation) of temporary facilities (construction camps, pipe yards and associated infrastructure); Upgrading of existing roads; Movement of vehicles, equipment and personnel; Production and disposal of solid and liquid wastes; Storage and handling of fuels and chemicals; Temporary construction camp operations; Preparation of the working strip (topsoil removal); Construction in elevated areas; Trenching, lowering and laying; Reanimation of subsurface contamination along the Working Strip (known sections limited to high nitrate levels); Backfilling and reinstatement of pipeline trench and temporarily disturbed land from construction; Pipeline cleaning and gauging; Special crossings (i.e. river crossings); Set up (including site preparation) and installation of compressor stations GCS00 and GCS01; Hydrotesting of pipeline; Set up of the pipeline facilities (including scrapers launchers / receivers and block valve stations)

- **Operation and maintenance phase**: Movement of vehicles, equipment and personnel; Earthworks to reveal the pipeline for maintenance/repair; Production and disposal of solid and liquid wastes

- **Decommissioning phase**: Movement of vehicles, equipment and personnel; Production and disposal of solid and liquid wastes; Demobilization and abandonment of facilities and infrastructure

10 Land take during construction will remain occupied by the Project component during operation until the decommissioning phase (when the structures are likely to be removed and the land reinstated to its former use). Permanent Project land take is given in Table 4-24

11 Temporary land take required for the compressor station construction camp (2 ha) (including an area for worker accommodation) will be included within the compressor station site boundary. Temporary land take for construction camps at special crossings and the BVSs is expected to be approx. 2,500 m² at each site, accommodating 10 to 20 workers during the construction time of a few weeks or months. This land take is included within the pipeline working strip.
Potentially Impacted Resources and Receptors
- Effects on the geomorphology due to erosion and landslides
- Effects on the soil quality

Particular Baseline Conditions that are Potentially Influencing Impacts/Risks
- Land use
- Soil quality characteristics
- Erosion of sensitive soils

Project Factors that are Potentially Influencing Impacts/Risks
- Project footprint
- Topsoil removal and reinstatement techniques
- Blasting and hammering techniques
- Specific techniques used for crossings (i.e. microtunnelling, open cut river crossings)
- Construction site and waste management
- Traffic management

References
- Baseline is found in Section 6.2.2. Impact Assessment Criteria is found in Annex 5.2. Monitoring Measures are described in Section 9.2.

Source: ERM (2012) and ASPROFOS (2013)

Table 8-25 presents the key potential impacts of the TAP Project on Subsurface and Soil during the key Project phases.

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disturbance and degradation of soil due to erosion, compaction, removal, modification of morphology, (especially along sections of elevated areas), collapse and sinkhole formation processes</td>
<td>Accidental pollution of soil by accidental spills</td>
<td>Accidental pollution of soil by accidental spills, solid and liquid wastes</td>
</tr>
<tr>
<td>Accidental pollution of soil by solid and liquid wastes or spills of hydrocarbons / fuels</td>
<td>Soil occupation / Surface Sealing</td>
<td>Soil occupation</td>
</tr>
<tr>
<td>Soil occupation / Surface sealing</td>
<td>Erosion of sloping terrain until vegetation cover has recovered and re-stabilised</td>
<td>Erosion and degradation of soil</td>
</tr>
<tr>
<td>Potential disturbance in case subsurface contamination is uncovered during trench / site excavation.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012) and ASPROFOS (2013)
8.5.2 Construction and Pre-commissioning Phase

8.5.2.1 Potential Impacts

8.5.2.1.1 Geohazards and seismicity assessment

Geohazards represent potential impacts to the project due to landslides and rock fall, soil liquefaction and karst formations but also seismic activities of the subsoil. These effects depend on numerous geological, geomorphological and geotechnical factors of the subsoil, surface and climatic conditions like soil types and grain sizes, mineral composition and stratification of rock formations, rock weathering process, slope angles of terrain surfaces, presence of groundwater in sediment deposits, rain fall characteristics or soil freezing, etc.

The in-depth assessment of the different phenomena requires thorough desktop analysis and field surveys including sampling and laboratory analysis as well as intensive evaluations of combined results. At the moment of this assessment only preliminary information can be provided which is going to be verified through different specific geotechnical and seismic investigations in future design steps of the project.

Areas for which a certain geohazard has been identified are some main river crossings (soil liquefaction); volcanic-post volcanic formations at the passage of Pefka, the Kirki Mountains, Schist formations of Kavala Mountains, Karst formations in the Alistrati Cave area, Gallikos River area, Gneiss formations with elluvial beddings in the Kroussia Mountain areas, potential soil creep and limestone Karst areas at the Vermio Mountain passage and eastern margins of Florina (slope instability, landslide, rockfall and karst),

Most common potential impacts to the pipeline itself include:

- Lateral pipe displacement;
- Pipe settlement due to landslides or soil liquefaction;
- Uplift (heave) of pipe due to landslides or buoyant rise due to soil liquefaction;
- Significant plastic deformation of the pipe wall material (due to compression, tension or shear strain by landslides, lateral spreads by soil liquefaction, due to subsidence of Karst or sink holes) and potential disruption;
- Spanning (i.e. the loss of ground support if a landslide removes the ground material over a significant length of the pipe trench) or temporary spanning from soil liquefaction;
- Increase of the static load upon the pipe (i.e. pipe is buried under landslide debris) Temporary increase of the dynamic load upon the pipe (i.e. is imposed by falling rocks).

Due to the selection of the GCS locations, these phenomena are not considered of relevance to the compressor stations sites.

The following Table 8-26 presents the assessment of the geohazards and the seismic activity along the route.

**Table 8-26 Geohazard and seismicity description**

<table>
<thead>
<tr>
<th>Section Approx. Chainage</th>
<th>Geohazards</th>
<th>Faults / Seismic Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Evros Area (KP 0 - 13)</td>
<td>River floodplain crossing: This river constitutes an area of potential soil liquefaction.</td>
<td>12 Normal Neotectonic faults at Peplos and Ardanio area do not present indication of recent activity.</td>
</tr>
<tr>
<td>Southern Evros (KP 13 – 62)</td>
<td>At the mountainous passages of the segment slope stability problems could occur during and after the construction. Special care must be taken and further slope stability investigation must be executed at the area of the passage of Pefka where the volcanic -postvolcanic formations usually present landslide danger. Also special care must be taken at Kirki mountains area where the route must follow direction vertical to the contour.</td>
<td>The 17 Normal Neotectonic faults at Kavissos, Pilea, Aetochori and Pefka-Loutros area define the contacts between several members of the volcanic series and do not present indication of recent activity. There are also 6 faults which as classified as faults of unknown activity.</td>
</tr>
<tr>
<td>Lowland of Evros (KP 62 – 86)</td>
<td>At the flat areas of the segment there is not any slope stability danger. The danger of potential liquefaction phenomenon has to be examined especially at the beds of the crossed streams where saturated soil conditions are expected.</td>
<td>No faults</td>
</tr>
<tr>
<td>Komotini – Xanthi Plain (KP 86 – 176)</td>
<td>Similar conditions with the above segment of the route. The danger of potential liquefaction phenomenon has to be examined especially at the beds of the crossed rivers. High aquifer also expected at the area.</td>
<td>The continuation of the Kavala – Xanthi-Komotini fault zone does not cross the pipeline route, but on this segment the route runs parallel and at a distance of up to 1 km from it. It generally divides the Paleozoic basement of Rhodope Massif to the NW from the sedimentary basin sequences to the SE. This continuation is classified as seismic to possible active.</td>
</tr>
<tr>
<td>KavalaMountains (KP 176 -193)</td>
<td>Potential slope stability issues especially at the Schist formations. Special care must be taken and further slope stability investigation must be executed at the area.</td>
<td>No faults</td>
</tr>
<tr>
<td>Section Approx. Chainage</td>
<td>Geohazards</td>
<td>Faults / Seismic Activity</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Filippoi Plain (KP 193 – 225)</td>
<td>The route passes at the boundary of the Filippoi Plain of the dried Swamps. Potential danger of organic turf content at the clayey soil could create instability conditions at the foundation of the pipeline. High aquifer is also anticipated.</td>
<td>No faults</td>
</tr>
<tr>
<td>Serres Plain (KP 225 – 295)</td>
<td>The route passes at the boundaries of a karst area for a length of 5 km near Alistratia Cave. At the plain of Strymon the potential liquefaction has to be examined. The area also presents high aquifer.</td>
<td>There are 2 Normal Neotectonic faults at Nea Zichni and Lefkothea vicinity with Pleistocene and Pliocene age and no indications of recent activity.</td>
</tr>
<tr>
<td>Kroussia Mountains (KP 295 – 329)</td>
<td>The Gneiss formations of the area characterized by deep weathering with the effect of the thick eluvial mantles. This could give rise to potential instability phenomena. So special care must be taken at the area in order to avoid land slide or instability areas.</td>
<td>There is one Neotectonic fault in the segment which defines the contact between Gneiss and Pleistocene sediments.</td>
</tr>
<tr>
<td>Gallikos Plain (KP 329 – 359)</td>
<td>At the limestones existence of karst areas has to be examined. Liquefaction examination must be executed at the vicinity of Gallikos River bed.</td>
<td>There is one fault of unknown activity and one Neotectonic fault buried under sediments.</td>
</tr>
<tr>
<td>Thessaloniki - Giannitsa Plain (KP 359 - 422.3)</td>
<td>Axios floodplain crossing: This river constitutes an area of potential soil liquefaction</td>
<td>1 Neotectonic fault at Axios valley with Pliocene age and no indications of recent activity.</td>
</tr>
<tr>
<td>Vermio Pass (KP 422.3 - 444.1)</td>
<td>Limestone karst terrain has to be expected along some alignment sections. Furthermore potential landslide areas in the south of the suggested route and landslide terrain in the north of the corridor, as well as shallow soil creep were investigated.</td>
<td>11 Pre-Neogene basement faults of unknown recent activity and 6 Normal high-angle faults (Kato Grammatiko area) classified as possibly area.</td>
</tr>
<tr>
<td>Eastern Margin of Florina, Vegoritis (KP 444.1 - 470.8)</td>
<td>Limestone karst terrain has to be expected along some alignment sections. A Landslide prone area is provided north of the route.</td>
<td>1 high-angle Normal fault classified as possibly active and 2 minor faults of unknown recent activity.</td>
</tr>
<tr>
<td>Ptolemais Basin (KP 470.8 - 491.5)</td>
<td>Due to the flat terrain landslides and landslide prone terrain are not expected to be very common terrain unit</td>
<td>1 vertical fault at Variko area classified as possibly active, 5 Neotectonic faults with no indications of recent activity and 2 faults of unknown recent activity.</td>
</tr>
<tr>
<td>Mount Askio Pass Kastoria Plains (KP 491.5 - 517.5)</td>
<td>Only a small surficial landslide was encountered. In some parts shallow eluvial covers are possibly affected by soil creep.</td>
<td>1 Neotectonic fault north of Variko with no indications of recent activity.</td>
</tr>
<tr>
<td>Aliakmon River Terraces (KP 517.5- 536.7)</td>
<td>Liquefaction prone terrain because of saturated, relatively uniform, fine grained deposits in a loose state. Very high liquefaction potential.</td>
<td>3 Neotectonic faults with no indications of recent activity and 1 possibly active fault north-western of Mesopotamia.</td>
</tr>
<tr>
<td>(KP 536.7 – 543)</td>
<td>The underground is made up of easily weathering, rippable bedrock. Moreover some sections of the corridor along a ridgeline is flanked by eroded landslides which are anticipated to be instable. Mainly erosion prone terrain partly affected by shallow soil creep and slope instability.</td>
<td>6 Neotectonic faults of Post-Miocene age and with no indications of recent activity.</td>
</tr>
</tbody>
</table>

Source: ASPROFOS (2013)
8.5.2.1.2 Soil Erosion

The soil structure varies along the pipeline corridor with the soil types\textsuperscript{12}. Along most of the route, soils have fairly good cohesion where soil structure provides for aggregate stability and reduces the likelihood of soil erosion. However, there are vulnerable sections (total appr. 133 km) where the soils erosion risk is particular high due to the soil properties and topography; these sections are identified in Table 6-9 and Table 6-10 (see Section 6.2.3).

The removal of vegetation and the trenching activities on the mountain steep slopes may result in significant permanent soil erosion impacts unless properly managed and mitigated. This is especially the case in areas where soil sensitivity is medium or high as depicted in the table above. The risk of soil erosion along these pipeline sections is considered to be minor or moderate respectively.

Of the 21 km of pipeline route identified for construction in elevated areas (divided into 7 individual sections), a total of 15.7 km is found in areas of medium to high soil erosion sensitivity. These sections of modification in elevated areas will be even more susceptible to erosion processes, where the topography is steeper, more exposed and potentially more subsurface and soil material will be permanently removed from the 18 km working strip during pipeline installation.

8.5.2.1.3 Soil Compaction

Soil compaction occurs when soil particles are pressed together, reducing the soil porosity. This increases the weight of solids per unit volume of soil (bulk density). Soil compaction can in general occur during most of the construction operations that require heavy machinery, especially if performed when soils are wet. In particular clay dominated soils are more susceptible to compaction.

As it is presented in the Table 6-9 and Table 6-10 (see Section 6.2.3) the soil structure varies along the proposed pipeline route. Along the pipeline corridor the sections of the proposed

\textsuperscript{12}According to Γιάσογλου, Ν., Κοσμοπούλου, Π., 2004 (eds). Χάρτης Εδαφικών Ενώσεων Ελλάδας. Εθνική Επιτροπή κατά της Ερημοποίησης, Γεωπονικό Πανεπιστήμιο Αθηνών (Giasoglou, N., Kosmopoulou, P 2004 (eds). Maps of Soil Units of Greece. National Committee against Desertification. Agricultural University of Athens)
pipeline route, there are vulnerable sections (total appr. 220 km) where the soils compaction risk is particular high due to the soil properties and topography. Also, the sections that exhibit moderate (total ca. 209 km) sensitivity for compaction.

During construction of the pipeline, trucks and heavy machinery will drive and operate along the construction corridor. Given the relatively short duration of the construction process and the fact that only the construction corridor will be affected, the magnitude of the impacts is considered small to medium. For the route sections of high sensitivity, as described above, the associated impacts are of major significance. For sections of medium sensitivity the associated impacts are of moderate significance.

Also, in the east section, the existing road network is assessed as adequate. Moreover, there will be no need of having new access roads due to the TAP’s pipeline route is parallel to DESFA’s. Only in a few cases the existing access roads might be needed to be widened. According to this, the impacts because of the temporary use of the access roads are of small significance.

Temporary Project installations\(^{13}\), such as pipe yards and camp sites, are also susceptible to soil compaction. The sensitivity of soil at the location of temporary installations is presented in Table 8-27.

<table>
<thead>
<tr>
<th>Installation</th>
<th>Chainage (KP)</th>
<th>Soil Typological Unit</th>
<th>Risk of soil compaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe yard 1</td>
<td>18.0</td>
<td>Calcaro-vertic Cambisol</td>
<td>Medium. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Camp site 1</td>
<td>40.0</td>
<td>Calcaro-vertic Cambisol</td>
<td>Medium. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Pipe yard 2</td>
<td>41.0</td>
<td>Calcaro-vertic Cambisol</td>
<td>High. The soils are clayey. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Pipe yard 3</td>
<td>70.0</td>
<td>Calcaro-vertic Cambisol</td>
<td>High. The soils are clayey. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Camp site 2</td>
<td>97.0</td>
<td>Calcaric Fluvisol</td>
<td>Medium. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Pipe yard 4</td>
<td>101.0</td>
<td>Calcaric Fluvisol</td>
<td>Medium. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Pipe yard 5</td>
<td>137.0</td>
<td>Chromic Luvisol</td>
<td>Medium. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Camp site 3</td>
<td>184.0</td>
<td>Rocks Outcrops</td>
<td>High. The soils are clayey. Heavy equipment can cause damage to the soil structure.</td>
</tr>
</tbody>
</table>

\(^{13}\)Source: GPL00-ENT-100-F-TRP-0003_08 – Logistic Study Greece East (01-02-2013) and GPL00-ILF-100-F-TRP-0003_00 – TAP-FEED-GR-PLN-REP-1575--APPENDIX 3 - Comparison of Logistic Concepts – Greece (05-04-2012)
<table>
<thead>
<tr>
<th>Installation</th>
<th>Chainage (KP)</th>
<th>Soil Typological Unit</th>
<th>Risk of soil compaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe yard 6</td>
<td>184.0</td>
<td>Rocks Outcrops</td>
<td>High. The soils are clayey. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Pipe yard 7</td>
<td>219.0</td>
<td>Calcaric Fluvisol</td>
<td>High. The soils are clayey. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Camp site 4</td>
<td>254.0</td>
<td>Calcaric Cambisol</td>
<td>Medium. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Pipe yard 8</td>
<td>254.0</td>
<td>Calcaric Cambisol</td>
<td>Medium. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Pipe yard 9</td>
<td>281.0</td>
<td>Calcaric Fluvisol</td>
<td>Medium. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Pipe yard 10</td>
<td>308.0</td>
<td>Chromic Luvisol</td>
<td>High. The soils are clayey. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Pipe yard 11</td>
<td>331.0</td>
<td>Rhodric Luvisol</td>
<td>Low. Heavy equipment cannot cause damage to the soil structure.</td>
</tr>
<tr>
<td>Camp site 5</td>
<td>332.0</td>
<td>Rhodric Luvisol</td>
<td>Low. Heavy equipment cannot cause damage to the soil structure.</td>
</tr>
<tr>
<td>Pipe yard 12</td>
<td>364.0</td>
<td>Calcaric Fluvisol</td>
<td>High. The soils are clayey. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Camp site 6</td>
<td>392.0</td>
<td>Calcaric Fluvisol</td>
<td>High. The soils are clayey. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Pipe yard 13</td>
<td>404.0</td>
<td>Calcaric Cambisol</td>
<td>Medium. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Pipe yard 14</td>
<td>449.0</td>
<td>Calcaric Leptosol</td>
<td>Low. The soils are well drained and the soil structure is strong</td>
</tr>
<tr>
<td>Camp site 7</td>
<td>458.0</td>
<td>Calcic Luvisol</td>
<td>High. Very high quality soils with high silt content, susceptible to structure deterioration when heavy equipment is used.</td>
</tr>
<tr>
<td>Pipe yard 15</td>
<td>480.0</td>
<td>Vertic Calcaric Luvisol</td>
<td>High. The soils are clayey. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Pipe yard 16</td>
<td>505.0</td>
<td>Calcaric Fluvisol</td>
<td>Medium. Heavy equipment can cause damage to the soil structure.</td>
</tr>
<tr>
<td>Camp site 8</td>
<td>515.0σ</td>
<td>Chromic Vertisol</td>
<td>High. Soils are susceptible to compaction when wet and tend to loose structure at reinstatement</td>
</tr>
</tbody>
</table>

Compiled APROFOS, EXERGIA (2013) and ERM (2012)

Given the relatively long time that the sites will be occupied (1-3 years, depending on the progress of the Project and the specific location) as well as the requirement of significant earthworks to remediate, the magnitude of impact is considered medium to high and the associated impacts of major significance. It is highlighted that this assessment has been done without taking into account any mitigation measures. Mitigation measures are presented in Section 8.5.2.2
8.5.2.1.4 Soil Pollution

Accidental pollution of soil during construction of the pipeline (along the construction corridor) and the above ground facilities could occur through direct spillage of materials such as oils or hydraulic fluids from vehicles and machinery, surface run-off and sanitary waste from construction sites. However, any potential spillages will generally be of small quantities and localized in nature, therefore the magnitude of such potential impacts is considered small. It is clarified that no permanent fuel tanks will be sited along the construction corridor but some of the long period construction sites may have large fuel tanks.

To present knowledge, the route is not passing through contaminated sites or any dump sites or uncontrolled waste landfills. However, along the construction corridor, undiscovered pollutants that may already be present in the soil from current or historical sources may also be encountered during excavation. This could potentially impact the construction workers health via inhalation of dust or direct ingestion, the land drainage network and then groundwater via rain water surface run-off from stockpiles. However, given the agricultural nature of the majority of the study area, it is very unlikely that contamination due to industrial activities will be encountered along the route. It is likely that diffuse impacts to soil from agricultural use can be detected. Given the agricultural patterns, potentially elevated nitrate levels could be expected to occur in the pipeline route sections that present in the Table 6-7 (see Section 6.2.3).

Soil investigations were performed at single locations along the route (see Section 6- 6.2.3 and Annex 6.6.3). Although no visible impacts were recorded at the sampling locations, chemical substances like Arsenic (As), Nickel (Ni), Vanadium (V) and Lead (Pb) as well as Polycyclic Aromatic Hydrocarbons (total PAHs) and Polychlorinated Biphenyls (PCBs) were detected in the soil analyses. All chemical concentrations are in the range of target values or slightly above but always below the intervention values.\(^\text{14}\) The main sources of these pollutants are likely to be agrochemicals, urban/industrial wastes and specific geological formations. Impacts to soil quality, health and safety of workers and to groundwater are considered to be of no significance.

Due to the use of agrochemicals (insecticides, pesticides, etc.) or other industrial activities in upstream or wider areas of the pipeline route potential diffuse heavy metals contamination as
well as elevated background level (geogenic) of soil are likely, due to air dispersion of dust particles or rainwater/surface water runoff via rivers. Impacts from the construction of the pipeline are not predictable.

The magnitude of potential impacts due to existing soil contamination is small. Overall, impacts of minor significance are anticipated to soil from potential contamination during construction from accidental spillages.

8.5.2.1.5 Reduced Soil Productivity

The construction of the pipeline, and specifically the works undertaken in the construction strip, despite the reinstatement of the land after pipeline construction, may have an effect on the ability of soil to perform its role in agricultural production, i.e. soil productivity. The sensitivity of soil is higher in areas where soil has a high agricultural value due to its quality to support agricultural production. Table 6-9 (see Section 6.2.3) summarizes soil type and quality along the pipeline route.

As expected, soil sensitivity as an agricultural resource is high or very high mostly in River Evros area and Komotini – Xanthi Plain, where there is already intense agricultural production. However, potential changes to soil productivity are generally of small magnitude as the soil will be effectively reinstated, as much as possible, in order to avoid any potential loss in productivity. Soil will only be affected in the construction corridor along the pipeline route (a working strip of max. 38m width). Therefore impacts to soil productivity are considered of minor significance.

8.5.2.2 Mitigation Measures

8.5.2.2.1 General measures

A number of mitigation measures will apply during pipeline construction to avoid or minimise impacts to soil and subsoil:
Topsoil, subsoils and any parent material removed will be separately stripped, handled, stored and replaced.

The topsoil will be temporarily stored on one side of the working strip. The non-fertile subsoil obtained from the pipeline trench excavation will be stored on the opposite side of the working strip. Fertile top soil must be re-deposited on top of the non-fertile soil to assure adequate crop / vegetation growth.

Timber silt fences, which will be removed after pipeline construction, should be placed perpendicular to the slopes. This is an important technique to mitigate the high risk of soil erosion, especially on the steeper sections of the mountains.

Fuel handling, especially bulk storage, will take place in secure bunded areas. Similar conditions will apply to lubricant oils, chemicals and liquid wastes. Should a spill occur, polluted soils will be cleaned up or removed for appropriate disposal. All wastes will be handled, stored and disposed of as per local regulations.

It is noted that the sites of BVS and the Compressor Stations will be permanently sealed (at least during the technical life time of the TAP’s Project). Consequently, the management of the excavated soil is described in the Solid Waste Management Plan (see Annex 8.4).

8.5.2.2 Geohazards and Seismicity Mitigation

The below mitigation measures are typical of the type that might be required. Final mitigation measures (including technical design) will be planned once the detailed geohazard study is completed. This also might require micro-reroutings.

Design measures to mitigate seismic wave loads are to locally increase the pipe wall thickness or to increase the pipeline flexibility through utilizing joints. The movements of faults at ground surface can be hindered to impact the pipeline by increasing the wall thickness, reducing the friction angle between the pipeline and the bending material through special coating or using special granular backfill/bedding material in combination with oversized trenches. Reducing the thickness of pipeline cover can also be applied at crossings with fault zones as an additional mitigation measure.

Soil liquefaction phenomena can be mitigated by increasing the density and strength of sandy materials, lowering the groundwater table or replacement of liquefiable soils. The cost and
environmental efficiency of this measure is restricted to ground surface near layers of liquefiable soil deposits and locally restricted areas of high groundwater table. For mitigation of impacts due to potential liquefaction in areas of river crossings, trenchless crossings could be designed to cross below liquefiable soil deposits.

Landslide effects can be mitigated through a set of construction design measures like using embankments at the basis of the slope or retaining structures, reducing the slope inclination with additional soil deposits or lowering groundwater levels, or even replacing or reinforcing sensitive soil layers. Impacts from rockfall can be mitigated by implementation of stoppers, barriers and/or wire fences.

Impacts from geohazards during construction phase can only be mitigated for rockfall and landslides with regard to reducing potentials for these incidents due to project induced earth movements, excavations or embankment works, and rock blasting activities through following international Best Practice for construction sites and implementing Health and Safety Management Plans and specific working activities instructions for geohazard areas.

8.5.2.2.3 Soil Erosion Mitigation

The restoration process will start as soon as the pipe is backfilled and will continue until the construction work area is reinstated and re-vegetated. All grade cuts will be replaced to their original contours and the work area will be seeded, fertilized and mulched to restore ground cover and to minimize erosion. Soil restoration and land reclamation techniques will be applied to control the high risk of erosion at the sections of Southern Evros, Lowlands of western part, Komotini – Xanthi Plain, Serres Plain and Gallikos Plain. These methods include seeding, hydrosedding, other soil revegetation practices and silt fences. Using the hydrosedding method, seed mixtures of endemic species and varieties already present in the section (fescue grass and legume seeds), mulch, fertilizer, tackifier and water are applied as a slurry mix. It is the most effective (optimum) method of obtaining growth on steep or difficult sites. Shrubs planting are deemed necessary at the sections with high precipitation, moderate – steep slopes and weak soil structure or structureless soils. Those techniques reduce the risk of soil erosion and assist the reinstatement. Silt fences which are used during construction to mitigate the high risk of soil erosion are important to remain there beyond the end of the pipeline construction activities in
order to assist the reinstatement. The seed mixtures which will be used by hydroseeding method are not the same for all the sections along the pipeline corridor. Different seed mixtures for each section are presented in Annex 8.4.

Where feasible, pipeline construction activities shall avoid the months of highest precipitation, because the risks of soil structure destruction and soil compaction is extremely high. Additionally, the high precipitation in combination with the structureless soils and the moderate – steep slopes, results in further increase of the already high risk of soil erosion. According to ombrothermic diagrams, pipeline construction activities will preferably take place during May/ June – September, when impacts on soils are not as significant as the months during the greatest precipitation. The preferred construction period for different pipeline sections (taking into account climatic differences) is indicated in Table 8-28.

Furthermore, it must be added here that the construction strip reinstatement will take place immediately afterwards, especially in the sites that have high or medium erosion sensitivity according to the international best practice, in order to reduce erosion risk.

<table>
<thead>
<tr>
<th>Section</th>
<th>KP</th>
<th>Dominant Soil Type</th>
<th>Construction period to minimize impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern Evros (KP 13.0 – 62.0)</td>
<td>45.3 – 58.7</td>
<td>EutricCambisol</td>
<td>late April - mid September</td>
</tr>
<tr>
<td></td>
<td>58.7 – 62.0</td>
<td>EutricCambisol</td>
<td>late April - mid September</td>
</tr>
<tr>
<td>Lowlands of western part (KP 62.0 – 86.0)</td>
<td>62.0 – 62.3</td>
<td>EutricCambisol</td>
<td>late May - early September</td>
</tr>
<tr>
<td>Komotini – Xanthi Plain (KP 86.0 – 176.0)</td>
<td>144.3 – 146.4</td>
<td>Calcaric Fluvisol</td>
<td>late April - mid September</td>
</tr>
<tr>
<td></td>
<td>146.4 – 153.0</td>
<td>Chromic Luvisol</td>
<td>late April - mid September</td>
</tr>
<tr>
<td></td>
<td>153.0 – 156.0</td>
<td>Rocks Outcrops</td>
<td>late April - mid September</td>
</tr>
<tr>
<td></td>
<td>156.0 – 157.5</td>
<td>Chromic Luvisol</td>
<td>late April - mid September</td>
</tr>
<tr>
<td></td>
<td>157.5 – 160.2</td>
<td>Calcaric Cambisol</td>
<td>late April - mid September</td>
</tr>
<tr>
<td></td>
<td>160.2 – 176.0</td>
<td>Rocks Outcrops</td>
<td>late April - mid September</td>
</tr>
<tr>
<td>Serres Plain (KP 225.0 – 295.0)</td>
<td>225.0 – 226.2</td>
<td>Calcaric Fluvisol</td>
<td>late April - mid September</td>
</tr>
<tr>
<td></td>
<td>226.2 – 230.1</td>
<td>Calcaro – Vertic Cambisol</td>
<td>late April - mid September</td>
</tr>
<tr>
<td>Gallikos Plain (KP 329.0 – 359.2)</td>
<td>329.0 – 331.0</td>
<td>Dystric Regosol</td>
<td>late April - early September</td>
</tr>
<tr>
<td></td>
<td>331.0 – 337.5</td>
<td>Rhodric Luvisol</td>
<td>late April - early September</td>
</tr>
<tr>
<td></td>
<td>337.5 – 339.7</td>
<td>Dystric Regosol</td>
<td>late April - early September</td>
</tr>
<tr>
<td></td>
<td>339.7 – 341.7</td>
<td>Rhodric Luvisol</td>
<td>late April - early September</td>
</tr>
</tbody>
</table>
Moreover, in addition to hydroseeding natural re-vegetation processes are expected to take place and must be monitored (see Section 9.3.18).

8.5.2.2.4 Soil Compaction Mitigation

The mitigation measures to address impacts from compaction during the pipeline construction are the following:

- Soil stockpiles from topsoil stripping will be approximately 2-3 m in height depending on local soil conditions, as well as working strip width and local coverage of the pipeline (i.e. required trench).
- Soil stockpiles will be protected from run-off, e.g. by heavy rainfall, by covering with sheets.
- Topsoil storage periods will be kept to a minimum. When there is a need to maintain topsoil stockpiles for larger periods of time, topsoil will be vegetated with fast growing seeds (e.g. mustard) to prevent entrainment by the wind or rain.
- Project vehicles and heavy machinery will use only the construction corridor and the access roads.
- For soils of high sensitivity to compaction (e.g. clayey soils, Luvisols) effort will be made to plan Project activities during the dry period.
- To reduce the compaction impact by the movements of heavy construction machinery (such as side booms with pipeline load, line pipe delivery trucks), temporary surface stabilisation materials will be installed on the section identified with highly compaction sensitive soils. State-of-the-art international best practice is driving mats or geotextile with gravel layer on top that distribute the pressure on the ground. These temporary driveways will be removed before working strip restoration.
Deep ploughing (subsoil de-compaction) will be applied to the construction zone as well as temporary construction facilities (such as pipe yards and construction camps) following project construction and will be performed during restoration. The deep ploughing will be performed on the entire working strip where topography allows to a depth of approximately 60 cm below surface, and if locally required due to equipment limitations diagonal and alongside the working strip.

8.5.2.2.5 Soil Pollution Mitigation

Localised soil pollution from construction activities can happen on any large construction site as the result of accidental spills of lubricants or fuels. In such cases, the polluted land will be immediately excavated, removed and processed as a dangerous/hazardous waste from an authorised contractor according to the Work Site Management Plan including Spill Handling Plan.

Based on the baseline data, collected so far, it is considered unlikely that any significant existing soil contamination will be encountered during the excavation of the pipeline trench. However, if potential contamination is encountered, the following measures will be taken:

- An assessment of the potential risks will be undertaken, including soil sampling if necessary;
- Appropriate Personal Protective Equipment will be used to protect the construction workers;
- The excavated contaminated soil will be segregated from the main stockpiles (in order to minimise the potential to impact the surrounding land and the potential for run-off to reach the land drainage network) and will be disposed of through a licensed waste contractor; and
- In the vicinity of any contamination, the pipeline trench will either be lined with impermeable materials or will be backfilled with low permeability materials such as clay. This is best industry practice in order to prevent migration of any contaminants in the wider area.
8.5.2.2.6 Reduced Soil Productivity Mitigation

The reinstatement measures described above such as storing aside fertile top soil, reducing the permanent effects from subsoil compaction and surface protection from erosion will contribute to reinstatement of soil productivity. Reinstatement of the excavated topsoil, retaining its biodiversity, reduces the presence of weeds in agricultural areas. In natural areas, no weed control is applicable since no weeds are considered.

8.5.2.3 Residual Impacts

Despite the application of various mitigation measures, typical residual long term impacts (observed on existing pipelines elsewhere) are the permanent changes in soil profile and water regime. This applies in particular to the soil moisture within the profile. Padding material in the trench such as sand tends to drain the soil profile above and next to the trench, while compacted subsoil with high loam or clay content could result in water logging below the re-applied topsoil in the affected working strip. Such effects are unavoidable but will not usually cause significant impacts on the agriculture or habitat function of the soils.

In areas where the sensitivity for soil erosion is high (Southern Evros, Lowlands of Evros, Komotini – Xanthi Plain, Serres Plain and Gallikos Plain), the application of mitigation measures will reduce impact significance.

For soils which are sensitive to disturbance and difficult to reinstate, reinstatement will inevitably take longer. With the application of best practice soil handling techniques as outlined above, no significant residual impacts are anticipated to soil structure as a result of compaction along most of the pipeline working corridor.

In areas where the route crosses clay soils, planning of construction activities during the driest part of the year will reduce the possibility of significant adverse impacts occurring. Residual impacts are therefore overall anticipated to be of minor to moderate significance to clay soils.
Soil compaction impacts at temporary construction sites and temporary pipe storage yards will remain as of moderate significance given the duration that the sites will be occupying (approximately 1-3 years), requiring significant earthworks to remediate.

Potential impacts associated with soil pollution will be minimised through good working practices as outlined above, waste storage handling and consideration during Project design. Therefore no residual significant impacts are anticipated from pollution related to accidental spills during construction.

A summary of residual impacts on the subsurface and soil resource along the pipeline route during the construction and pre-commissioning phase is provided in Table 8-29. At present residual impacts resulting from geohazards and seismicity cannot be evaluated. Further detailed technical studies will be prepared to evaluate the impacts and to define final mitigation measures.

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction and Pre-commissioning Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil Erosion</td>
<td>• Top soil will be removed prior to construction, properly stored and reinstated after construction – an Erosion and Sediments Control Plan will be developed as part of the ESMMP in order to detail procedures of restoration works.</td>
<td>MODERATE</td>
</tr>
<tr>
<td></td>
<td>• The Erosion and Sediments Control Plan will identify specific measures to mitigate impacts along sections of the route especially susceptible to erosion (i.e. particular modified sections in elevated areas).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Original surface contours will be reinstated after construction where practical.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Soil restoration techniques will include seeding, hydroseeding, other soil re-vegetation practices and silt fences.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pipeline construction activities will avoid the months of greatest precipitation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hydroseeding and shrubs planting will be done immediately after the pipeline construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Storage of the original surface soil resources along pipeline (to be re-used)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Promotion and monitoring of natural re-vegetation processes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Silt fences. will be placed perpendicular to the slopes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MINOR</td>
<td>Minor impacts are anticipated.</td>
</tr>
</tbody>
</table>
## Impact / Risk

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Compaction</td>
<td>- Topsoil stockpiles will be approximately 2-3 m in height</td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>- Soil stockpiles will be protected from heavy rainfall (covering).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Topsoil storage periods will be kept to a minimum otherwise will be vegetated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Access areas to heavy machinery will be restricted to the construction zone and access roads.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- On sensitive soils construction activities will be planned for the dry period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Deep ploughing will be applied following construction all along the construction strip.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MINOR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Minor residual impacts are anticipated for the pipeline route.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Minor to Moderate impacts are anticipated for clayey soils</td>
<td></td>
</tr>
<tr>
<td>Soil Pollution and accidental spills</td>
<td>- Work Site Management Plan incl. Spill Handling Plan</td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>- In case existing pollution is encountered, activation of Contaminated Lands Management Plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Assessment of the potential risks, including soil sampling if necessary</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Use of Personal Protective Equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Segregation of the excavated contaminated soil and management as hazardous waste</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- The pipeline trench will either be lined with impermeable materials or will be backfilled with</td>
<td></td>
</tr>
<tr>
<td></td>
<td>low permeability materials such as clay.</td>
<td></td>
</tr>
<tr>
<td>Reduced Soil Productivity</td>
<td>- No specific mitigation is anticipated</td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>MINOR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Minor impacts are anticipated.</td>
<td></td>
</tr>
</tbody>
</table>

**ERM (2012)**

### 8.5.3 Operation and Maintenance Phase

#### 8.5.3.1 Potential Impacts

No significant impacts to soil and subsoil are envisaged during Project operations. Agricultural soil can continue to be used with a ploughing depth to 30 cm. As part of the pipeline route management, the pipeline protection strip (8 m width) will be kept free from any deep rooting vegetation. In order to protect soil, ground- and surface waters, this will be achieved by physical means; no application of herbicides, defoliant etc. will be allowed.
The potential to induce dynamics of subsoil due to the project is restricted to very limited activities such as erosion control or excavations for repairs. No significant impacts to geohazards, including landslides are expected.

8.5.3.2 Mitigation Measures

The Pipeline Route Maintenance Plan will include besides vegetation clearing, to periodically check for any surface erosion and to devise stabilization measures where needed to remediate or prevent topsoil losses on the reinstated construction strip.

In case that any external pipeline maintenance becomes necessary, i.e. excavation of a pipeline section for repair (which will be an exceptional case), impacts and mitigation at the particular location will be similar to those of the construction stage.

During the operational lifetime of the Project, construction phase restoration earthworks performed along the temporary working strip (18 m) of the modification sections in elevated areas, will assist in regenerating the soils and vegetation cover. Reinstatement will take place in a way that shallow-rooting vegetation (e.g. grass) can grow along the PPS (8m) and around the permanent 6 m maintenance access road.

Technical design of the pipeline in geohazard prone areas would also include mitigation of geohazard risk to the pipeline during operations.

8.5.3.3 Residual Impacts

After construction reinstatement, the modified soils will develop depending on their further use and vegetation cover during the time of construction.

Full restoration of any soil cover to its original state along the modified sections in elevated areas, may not be feasible owing to the increased risk of erosion. However, vegetation will eventually re-establish itself naturally, although very slowly due to the thin soils, exposed and steep topography of these areas.
8.5.4 Decommissioning Phase

8.5.4.1 Potential Impacts

Depending on the approach and technologies available at decommissioning stage, the pipeline may either stay in the ground or will be taken out partly or completely. Regarding soil impacts, in the case of taking the pipeline out, impacts will be similar to construction stage. Soil profiles will be disturbed, but as TAP will follow the international best practice during the construction and decommissioning phase (diligent care in excavation, separation and appropriate storage of topsoil and subsoil, de-compacting of working strip, after deconstruction) it is ensured, that soils will be reinstated to their previous conditions, as close as technically feasible. This way, soils will be available again for agricultural use and re-vegetation in non-agricultural use areas. However, it is obvious that soil profiles that have been disturbed several times will not have the same properties as the surrounding original soils.

8.5.4.2 Mitigation Measures

In case the pipeline is taken out of the ground, mitigation measures for soil protection and reinstatement will be the same or similar to the ones described for construction. Mitigation measures will be planned according to the best practice available at the time of decommissioning (i.e. in 50 years).

8.5.4.3 Residual Impacts

Residual impacts from construction will either remain similar or be aggravated by decommissioning; especially in case the pipeline is taken out of the ground and construction activities will occur in reverse order.

In case the pipeline is left in situ, the soil conditions that have developed over the lifetime of the Project (nominal 50 years) will continue to prevail.
In case the sites of the compressor stations and BVSs are abandoned by removal, artificial soil profiles will remain at the footprints after reinstatement, which depending on the composition of the replaced sub and topsoil layers are expected to be suitable vegetation habitats.

8.5.5 Summary of Impacts on Subsurface and Soil Resources

Construction and Pre-Commissioning Phase:
Permanent changes of ground surface and loss of soil will take place at the compressor station sites which are presently located agricultural fields. GCS00 and GCS01 will result in the permanent loss of 16 ha due to surface sealing where buildings and installations will be located. Surface loss for the BVS, in total, will be approximately 1.55 ha. Some additional soil will be lost due to the upgrade of approximately 30 km of existing roads where these are widened. Surplus fertile topsoil will be used for landscaping.

Soils that will be affected by the pipeline working strip arise approximately to 2,063.4 ha. The construction activities (mainly removal of vegetation and trenching) carried out along the working strip can lead to soil erosion and compaction. Approximately 220.0 km of the route (about 836.0 ha working strip) were identified as sensitive to compaction and approximately 133 km of the route (about 505.4 ha working strip) are sensitive to erosion.

Areas vulnerable to high erosion are predominantly found on the steeper slopes. Soil compaction will generally occur during most of the construction activities involving heavy machinery, especially when the soil is wet. The most sensitive areas, due to the nature of the soil, are located at River Evros, Lowlands of Evros, Kavala Mountains, Turf Area and Kroussia Mountains.

To avoid or reduce erosion and compaction, established mitigation methods will be applied during construction and reinstatement and soils in the construction strip are anticipated to return to previous agricultural productivity.

The removal and storage of topsoil, subsoil and any parent material will be managed to facilitate the restoration stage. Preconstruction ‘condition’ surveys will be undertaken to allow construction sites to be reinstated close to their original state, including surface contours. The sites will be re-vegetated immediately after construction. In those areas identified as more sensitive,
construction will be limited to dry periods. Additionally, deep ploughing will be applied immediately following construction. The construction of the pipeline may also reduce the productivity of soils in those agricultural areas where Project activities take place. However, proper reinstatement measures, such as the appropriate storage of fertile topsoils separately from less productive sub soils will greatly reduce impact on productivity qualities of the soils when reinstated after construction.

Large construction sites have a risk potential for soil pollution through accidental spills of fuels and lubricant or improper disposal of waste and wastewater. Such potential sources of impact can however be largely avoided by compliant wastewater treatment, waste management, proper storage and storage of polluting substances, i.e. Good housekeeping practice construction management by the EPC contractor. A Spill Contingency and Response Plan to prevent and respond to any spill will be implemented. Accidentally polluted soil will be excavated and disposed of as waste according to the type of pollution. Except for some route sections with elevated nitrate concentrations from agricultural activities the pipeline route is not passing through any known contaminated land. In case any contaminated soil is encountered along the route, this will need to be properly excavated with diligent care and disposed off according to national waste regulations as hazardous waste.

**Operation and Maintenance Phase:**
Pipeline route maintenance involves only occasional route inspection by vehicles. Reinstated areas of agricultural land can be ploughed to 30 cm depth. During operation there are no activities that may result in any significant impacts to soils.

**Decommissioning Phase:**
With a design pipeline life of 50 years, it is currently uncertain which decommissioning approach will be adopted at the end of the Project lifetime. Current international best practice is to leave a pipeline in the ground (abandonment-in-place), and secure it against structural collapse, in which case impacts on the landscape will be minimal. A possible dismantling of permanent Project facilities (compressor stations, block valve stations) would cause similar disturbance to soil and subsoil as the ones described for the construction phase. With the implementation of the appropriate mitigation measures such impacts are considered of minor significance.
8.6 Landscape and Visual Amenity

8.6.1 Overview

This section assesses the potential impacts on the landscape and visual amenity associated with the Project in Greece. Impacts may occur on a landscape resource, such as a high landscape value, or a sensitive receptor, such as frequently used roads. The assessment is divided into the three main phases of the Project: construction, operation and decommissioning.

Pipeline construction will result in a clearance of a regular 38 m wide working strip along the approximately 543 km long pipeline route (total 2,063 ha) in Greece, although a reduced (28 m) or minimum (18 m) working strip will be utilised in some areas due to construction constraints. For instance, a minimum working strip will be implemented along the 7 sections in elevated areas identified as requiring modification (21 km in total), as physical and topographical constraints limit the land area available for construction activities.

During operation, an 8 m Pipeline Protection Strip (PPS) will be kept clear of deep rooted species, but otherwise reinstated to the previous conditions, as much as possible. Temporary facilities include pipeyards (11 on the first section and 6 on the second section) and construction camps (5 on the first section and 3 on the second section). Final selection of the exact location and number of the pipeyards and construction camps will be defined by the EPC contractor prior construction beginning. Permanent facilities include 22 block valve stations and two Compressor Stations (for the initial 10 bcm/year phase only one will be established in the broader area of Kipoi).

The main sources of landscape and visual amenity impact and potentially impacted resources and receptors associated with the TAP Project are presented in Box 8-5 below.

**Box 8-5 Key Considerations for Assessment – Landscape and Visual**

**Sources of Impact/Risk**

- Construction and Pre-Commissioning Phase: land clearance for the construction of the pipeline trench, access roads, temporary and permanent facilities. Stockpiling of topsoil and subsoil, pipeline installation, erection of permanent and temporary structures (GCS, BVSs, construction camps, pipe yards), movement of project vehicles and machinery, reinstatement of pipeline trench and temporarily disturbed land from construction.
Operation Phase: Permanent pipeline protection strip or PPS (8m wide) cleared of woody vegetation, above ground project structures, such as the GCS and BVSs; and permanent changes to topography arising from modifications to elevated areas.

Decommissioning and Reinstatement Phase: Demobilization and Abandonment of facilities and infrastructure

Potentially Impacted Resources and Receptors

- Landscape and visual receptors (local inhabitants, commuters, by-passers, tourists, etc.)

Particular Baseline Factors that are Potentially Influencing Impacts/Risks

- Areas of high landscape value
- Forests
- River crossings
- Extent and distribution of visual receptors around the site.

Project Factors that are Potentially Influencing Impacts/Risks

- Size of aboveground permanent installations (GCS, BVSs)
- Temporary installations (pipe yards, camp sites)

References

- Baseline is found in Section 6.2.8. Impact Assessment Criteria is found in Annex 5.4. Monitoring Measures are described in Section 9.2. Photomontages are presented in Annex 6.6.4, Supplement III.

Source: ERM (2012), ASPROFOS (2013)

The following Table 8-30 presents the key potential impacts of the TAP Project on landscape and visual amenity during all Project phases.

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical changes to the landscape general unity (fragmentation) due to construction works, signs etc.</td>
<td>Presence of PPS (8 m wide) in the receiving landscape especially landscapes cleared of woody vegetation for this purpose.</td>
<td>Permanent loss of some landscape elements/features</td>
</tr>
<tr>
<td>Impacts to landscape and visual amenity from construction works in elevated areas, especially earthworks.</td>
<td>Presence of block valve stations and compressor stations in the receiving landscape</td>
<td>Disturbance of the landscape unity by demobilization and abandonment of facilities and infrastructure</td>
</tr>
<tr>
<td>Disturbance of the landscape habitats’ features continuity such as the mature trees (felling of trees) or watercourses</td>
<td>Altering to elevated areas as required along proposed modification sections, plus presence of permanent access road</td>
<td></td>
</tr>
<tr>
<td>Interruption of agricultural activities and use of farmlands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes in the viewshed and aesthetic value to residents</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ERM (2012)

In the following Sections, each potential impact is analysed providing a discussion on how each source is likely to have an impact on the receptor and the mitigation measures incorporated within the Project to reduce any negative impacts.
It is reminded that the impact assessment criteria and methodology are described in Section 5 and the associated Annex.

8.6.2 Construction and Pre-commissioning Phase

8.6.2.1 Overview

Project construction works will cause visual impacts on the surrounding landscape and visual amenity of sensitive receptors. These will be temporary and restricted to the construction period but the magnitude of change is likely to be greater than in other phases. Project features or processes that will be visible and/or intrude upon existing visual amenity will include:

- Construction of the pipeline corridor.
- Construction of the permanent Project features, such as the block valve stations and the compressor station.
- Construction of the temporary Project features such as the pipe yards and construction camps.

8.6.2.2 Potential Impacts

8.6.2.2.1 Physical Changes to the Landscape General Unity

Construction activities will result in physical changes to the overall landscape's unity. According to the results of the baseline field survey (see Section 6.2.8), the landscape of the pipeline corridor mainly consists of wide unified areas of agricultural land, forests and riparian lands.

Impact significance due to physical changes caused by pipeline construction is related to the landscape character and value of the areas concerned.

With regard to the landscape character, the character types affected by the Project (intersected by the Project footprint) and their sensitivity are shown in the Table 8-31.
### Table 8-31  Landscape Character Types Quality Assessment

<table>
<thead>
<tr>
<th>Landscape Character Types</th>
<th>Sections</th>
<th>Quality</th>
<th>Sensitivity to the proposed changed</th>
<th>Total length through landscape type (km)</th>
<th>Magnitude of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain agricultural areas</td>
<td>River Evros area, Southern Evros, Lowlands of Evros, Komotini-Xanthi Plain, Kavala Mountains, Filippoi Plain, Serres Plain, Gallikos Plain, Axios Plain</td>
<td>Ordinary</td>
<td>Low</td>
<td>316.55</td>
<td>Small</td>
</tr>
<tr>
<td>Mountainous forested areas</td>
<td>Southern Evros, Kavala Mountains, Kroussia Mountains, Vermio Mountain, Askio Mountain, Kastoria-to-Border</td>
<td>High</td>
<td>High</td>
<td>76.17</td>
<td>High</td>
</tr>
<tr>
<td>Mixed forest and shrublands</td>
<td>Serres Plain, Kroussia Mountain, Gallikos Plain</td>
<td>Good</td>
<td>Medium</td>
<td>32.09</td>
<td>Small</td>
</tr>
<tr>
<td>Mixed agricultural and urban or industrial features</td>
<td>Komotini-Xanthi Plain, Kavala Mountains</td>
<td>Ordinary</td>
<td>Low</td>
<td>8.93</td>
<td>Small</td>
</tr>
<tr>
<td>Hilly shrublands and grasslands</td>
<td>Southern Evros, Lowlands of Evros, Filippoi Plain, Serres Plain</td>
<td>Ordinary</td>
<td>Low</td>
<td>8.76</td>
<td>Small</td>
</tr>
<tr>
<td>Hilly mixed grasslands and agricultural areas</td>
<td>Kroussia Mountains</td>
<td>Good</td>
<td>Low</td>
<td>7.41</td>
<td>Small</td>
</tr>
<tr>
<td>Urban and industrial areas</td>
<td>Komotini-Xanthi Plain, Serres Plain, Axios Plain, Ptolemaida Basin</td>
<td>Ordinary</td>
<td>Low</td>
<td>0.22</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Mixed riparian forested and agricultural areas</td>
<td>Komotini-Xanthi Plain, Serres Plain, Ptolemaida Basin, Askio Mountain</td>
<td>Good</td>
<td>Medium</td>
<td>1.41</td>
<td>Small</td>
</tr>
<tr>
<td>Evros wetland</td>
<td>River Evros area</td>
<td>High</td>
<td>Medium</td>
<td>0.635</td>
<td>Small</td>
</tr>
<tr>
<td>Riparian forested areas</td>
<td>Komotini-Xanthi Plain, Axios Plain</td>
<td>High</td>
<td>Medium</td>
<td>2.55</td>
<td>Medium</td>
</tr>
<tr>
<td>Mixed agricultural areas with narrow valleys</td>
<td>Axios Plain</td>
<td>Good</td>
<td>Medium</td>
<td>2.2</td>
<td>Small</td>
</tr>
<tr>
<td>Mixed grasslands and agricultural areas</td>
<td>Vermio Mountain</td>
<td>Ordinary</td>
<td>Low</td>
<td>1.8</td>
<td>Small</td>
</tr>
<tr>
<td>Upland agricultural areas</td>
<td>Vermio Mountain, Ptolemaida Basin, Askio Mountain, Kastoria-to-Border</td>
<td>Good</td>
<td>Low</td>
<td>50.2</td>
<td>Small</td>
</tr>
<tr>
<td>Mountainous shrublands and grasslands</td>
<td>Vermio Mountain, Ptolemaida Basin</td>
<td>Ordinary</td>
<td>Low</td>
<td>15.5</td>
<td>Small</td>
</tr>
<tr>
<td>Mountainous mixed agricultural areas with narrow valleys</td>
<td>Kastoria-to-Border</td>
<td>Good</td>
<td>Medium</td>
<td>1.5</td>
<td>Small</td>
</tr>
<tr>
<td>Kastoria wetland</td>
<td>Kastoria-to-Border</td>
<td>Highest</td>
<td>High</td>
<td>0</td>
<td>Low</td>
</tr>
</tbody>
</table>


The sensitivity of the specific landscape characters is generally low, as most of them can easily accommodate the envisaged changes, with the exception of narrow valleys, wetlands and forested areas. The sensitivity is high in forested areas (riparian or mountainous), where changes cannot be accommodated. It is clarified, that landscape’s capacity to accommodate changes is based on the morphology, vegetation, diversity and human activities. An area of gentle slopes or intense human activity can easily accommodate changes to the landscape; in areas of thick...
vegetation, any restriction on re-vegetation would result in decrease of landscape's capacity to absorb the incurred modification.

As described in Annex 5, magnitude of impact depends on the nature, scale and duration of the particular change in the landscape and the overall effect on a particular view. Consequently, the magnitude of change caused by Project activities is also considered higher in forested areas, where land clearance creates a visible scar in the continuity of the forested area. The resulting impact significance is small to medium in all cases with the exception of the mountainous forested areas (Rhodopi mountain in Southern Evros Section, Symvoli and Lekani Mountains in Kavala Mountains, Kroussia Mountains, Vermio and Askio mountains as well as the area west of Kastoria), where the impacts are high.

A number of areas of high landscape value have been identified in the study area, as a result of the baseline study. Some of them are crossed by the proposed pipeline route while others are in the vicinity. An overview of the anticipated impacts to areas of high landscape value is given in Table 8-32.

<table>
<thead>
<tr>
<th>Site</th>
<th>Location (KP)</th>
<th>Physical disturbance</th>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evros River and its Delta</td>
<td>0-1</td>
<td>Crossed</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>Proximity (3.4 km)</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Wildlife refuge of Pylaia – Kavissos - Feres</td>
<td>15.5-17</td>
<td>Proximity (1.8 km)</td>
<td>Medium</td>
<td>Small</td>
</tr>
<tr>
<td>South Forest Complex of Evros</td>
<td>21-33</td>
<td>Crossed</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>49.5-50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wildlife refuge of Kirk</td>
<td>50-53.5</td>
<td>Crossed</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Filiouris (Lissos) River</td>
<td>77</td>
<td>Crossed</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>Bosbozis (Bosbos) River</td>
<td>98</td>
<td>Crossed</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Nestos River</td>
<td>154</td>
<td>Crossed</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Palaia Kavala</td>
<td>187-190</td>
<td>Proximity (1.7 km)</td>
<td>High</td>
<td>Small</td>
</tr>
<tr>
<td>Aesthetic Forest of Kavala – Amygdalena/ Wildlife Refuge of Agios Timotheos – Kioupia</td>
<td>187-190</td>
<td>Crossed</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Eletheroupoli Preserved Settlement</td>
<td>206</td>
<td>Proximity (1 km)</td>
<td>Medium</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Mount Paggai</td>
<td>207-215</td>
<td>Proximity (1.5 km)</td>
<td>High</td>
<td>Small</td>
</tr>
<tr>
<td>Aggits Gorge and Alistrati Caves</td>
<td>237-243</td>
<td>Proximity (0.5 m)</td>
<td>High</td>
<td>Small</td>
</tr>
<tr>
<td>Kroussia Mountains</td>
<td>303-307</td>
<td>Crossed</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Axios River</td>
<td>376-377</td>
<td>Crossed</td>
<td>Medium</td>
<td>Small</td>
</tr>
<tr>
<td>Loudias river</td>
<td>394</td>
<td>Proximity (200 m)</td>
<td>Medium</td>
<td>Small</td>
</tr>
</tbody>
</table>
On the basis of the Table above and to the Evaluation of Significance Matrix (see Annex 5), impacts to areas of high landscape value are considered of minor significance for most of the cases, with the exception of the forested slopes of South Forest Complex of Evros, the area of Wildlife Refuge of Kirki, Wildlife Refuge of Agios Timotheos – Kioupia, Kroussia Mountains, Vermio Mountain and the area of Kleisoura, Lehovo and Variko, and the Rivers of Bosbozis and Nestos, where impacts are considered to be of moderate significance.

**Construction in elevated areas**

The installation of the pipeline through the more mountainous regions (i.e. Vermio Mountain) will require 7 sections of modification to the natural topography, totalling 21 km along the entire 543 km pipeline route. The specific KPs for these proposed sections are:

- KP 427.2 to 433.1;
- KP 434.1 to 438.8;
- KP 439.9 to 442.9;
- KP 443.6 to 444.9;
- KP 489.0 to 489.8;
- KP 495.1 to 497.0; and
- KP 540.5 to 543.0.

During construction, the affected sections will be modified in order to allow pipe laying works to take place on a limited, but flat, working strip 18 m wide (16 m plus 1 m on either side totalling). Further information on the construction technique is presented in Section 4.
Impacts on landscape and visual amenity will arise along these sections during construction due to:

- Presence, movement and operation of construction plant equipment and other Project associated traffic; and
- Activities associated with vegetation clearance, soil stripping and earthworks to create the required 18 m wide working strip.

A 6 m wide access road will also be constructed within the working strip, alongside the pipeline, to allow access for construction machinery, as shown in Annex 3.6. The access road will remain after reinstatement of the modified sections for maintenance purposes - refer to Section 8.6.3 for operational impacts.

Additional field survey work will be required to establish the visual receptors and sensitivity of the specific modified sections.

8.6.2.2.2 Disturbance of the Continuity of Landscape Habitat Features

The disturbance of the continuity of landscape habitat features includes loss of trees (either mature/rare or not) in forested areas. This is mainly the case along the pipeline corridor; every effort has been made to minimize installation of block valve stations, pipe yards, construction camps and compressor station locations in forested areas. Loss of trees is mostly focused in the South Forest Complex of Evros, in Kavala Mountains, in Kroussia Mountains, in Vermio and Askio Mountains and near the Greek/Albanian borders where most of the forests are located. Taking into account the sensitivity of the forested areas to the changes caused by the pipeline construction works and the magnitude of change anticipated (see Table 8-31 and Table 8-32) the associated impacts are considered of moderate significance.

Loss of shrubs and native grass habitat in grasslands and shrublands of the study area may occur as a result of the clearance of the areas for the construction works. Given the low sensitivity of the specific landscape type and the small magnitude of change anticipated (see Table 8-31 and Table 8-32) the associated impacts are considered of minor significance.
Disturbance of landscape habitat features also include loss of riparian vegetation and continuity at streams or rivers that cut across the pipeline route (Filliouris, Bosbozis, Nestos, Axios, Aliakmonas, etc.). The riparian vegetation at the crossings of Filliouris River, Nestos River and Axios River is considered to be an area of high landscape value. With the use of HDD as the crossing technique no impacts are envisaged on the high quality riparian vegetation closest to the watercourse channel. In other rivers with rich riparian vegetation, as Bosbozis River, narrowing of the working strip can minimize impacts of the project. The crossing of the Aliakmonas River takes place in an area characterized as “upland agricultural area” landscape, which exhibits low sensitivity. Therefore, impacts to this landscape are considered to be of minor significance.

8.6.2.2.3 Interruption of Agricultural Activities and Use of Farmlands

Agricultural landscapes cover most of the project study area. Although this landscape type is of limited value, impacts could incur by the project footprint. The interruption of agricultural activities and use of farmlands mainly includes:

- Fragmentation of farmlands along the pipeline route and other pipeline establishments (pipeyards etc.); and
- Interruption of agricultural activities due to construction works as these are described in Box 8-5.

These impacts are expected along most of the pipeline route since it covers mostly agricultural areas (River Evros, Lowlands of Evros, Komotini – Xanthi Plain, Turf Area, Serres Plain, Gallikos Plain, Giannitsa Plain, Eordaia Plain, Ptolemaida basin etc.). The sensitivity of the specific landscape types are generally low and the magnitude of change is imperceptible or small. Taking also into account the temporary nature of the construction works, the associated impacts are considered of minor significance.

8.6.2.2.4 Changes in the Viewshed and Aesthetic Value to Residents

The construction sites will generally be observed by a range of viewers, including:

- Residents with prolonged viewing opportunities of their landscape setting.
• Outdoor workers (farmers etc.) with a moderate interest in their environment.

• Nature recreation focused users and tourists that appreciate the local visual amenity (e.g. the forested slopes of South Forest Complex of Evros, Kavala Mountains, Kroussia Mountains, and Vermio Mountain).

Receptors that will experience a change in their visual environment are generally likely to view construction activities from a short distance, through scattered vegetation across gently or undulating topography of plain areas along the Project corridor. The main visual impacts likely to be experienced during construction phase will be temporary and restricted to the construction period and will include:

• The presence of construction vehicles and workers;
• Movement of construction machinery, workers and large scale construction equipment;
• Stockpiles (vegetation, topsoil, subsoil);
• Vegetation clearance;
• Earth works, construction and installation of Project elements;
• Lighting during night time construction activities (if required) and site compounds; and
• Additional vehicular traffic generated by construction workers, materials delivery and disposal along adjacent transport routes and associated traffic management.

The assessment of the impacts to the viewshed is based on field survey results overviewing the pipeline route and the location of permanent and temporary installations. The results of this assessment for the pipeline and the temporary installations are presented below, while permanent installations are examined during the operations phase assessment.

Pipeline Route:
The visual amenity of the study area refers to several viewpoints along the pipeline route that represent a range of different viewer types and viewing opportunities. Table 8-33 presents the evaluation of the sensitivity for each of the receptors selected.
### Table 8-33 Pipeline – Visual Receptor Impacts

<table>
<thead>
<tr>
<th>KP</th>
<th>Location</th>
<th>Distance in km to pipeline</th>
<th>Direction of view</th>
<th>Receptor type</th>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Thymaria</td>
<td>2.8</td>
<td>Viewing south towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>5.5</td>
<td>Peplos</td>
<td>1.2</td>
<td>Viewing north towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>6.8</td>
<td>Tavri</td>
<td>1.4</td>
<td>Viewing south towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>13</td>
<td>River Mega</td>
<td>0.05</td>
<td>Viewing north towards the pipeline</td>
<td>River</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>11</td>
<td>Kavisos</td>
<td>0.02</td>
<td>Viewing north towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>28.2</td>
<td>Pefka</td>
<td>0.01</td>
<td>Viewing north towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>28.5</td>
<td>Loutros</td>
<td>2.5</td>
<td>Viewing north towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>31.7</td>
<td>Aetochorio</td>
<td>0.1</td>
<td>Viewing south towards the pipeline</td>
<td>Village/Monastery</td>
<td>Medium</td>
<td>Small</td>
</tr>
<tr>
<td>34.4</td>
<td>Aristinon</td>
<td>0.3</td>
<td>Viewing north towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>35.1</td>
<td>Agnantia</td>
<td>1.0</td>
<td>Viewing south towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>40.2</td>
<td>Amfitriti</td>
<td>0.01</td>
<td>Viewing south towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>41.2</td>
<td>Eirini</td>
<td>0.01</td>
<td>Viewing north towards the pipeline</td>
<td>Village/brook</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>44.8</td>
<td>Palagia</td>
<td>0.004</td>
<td>Viewing south towards the pipeline</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>50.4</td>
<td>Area of Kirki</td>
<td>0.02</td>
<td>Viewing east towards the pipeline</td>
<td>Track</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>66.1</td>
<td>Outskirts of Chamilo</td>
<td>0.8</td>
<td>Viewing east towards the pipeline</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>77.1</td>
<td>Outskirts of Lofario</td>
<td>0.1</td>
<td>Viewing north towards the pipeline</td>
<td>Village/brook</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>81.3</td>
<td>Makropotamos river</td>
<td>0.8</td>
<td>Viewing north towards the pipeline</td>
<td>River</td>
<td>Medium</td>
<td>Small</td>
</tr>
<tr>
<td>81.9</td>
<td>Outskirts of Pamforo</td>
<td>0.9</td>
<td>Viewing north towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>86.3</td>
<td>Outskirts of Thrylorio</td>
<td>0.02</td>
<td>Viewing south towards the pipeline</td>
<td>Village/brook</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>87</td>
<td>Outskirts of Fylakas</td>
<td>0.6</td>
<td>Viewing north towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>98</td>
<td>BosbozisRiver</td>
<td>0.5</td>
<td>Viewing north towards the pipeline</td>
<td>River</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>100</td>
<td>Outskirts of Mesochori</td>
<td>0</td>
<td>Viewing west along the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>104</td>
<td>AspropotamosRiver</td>
<td>0.3</td>
<td>Viewing northwest towards the pipeline</td>
<td>River</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>113</td>
<td>Outskirts of Galini</td>
<td>0.69</td>
<td>Viewing southwest towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
</tbody>
</table>
### Project Title:
Trans Adriatic Pipeline – TAP

### Document Title:
Integrated ESIA Greece

Section 8 - Assessment of Impacts and Mitigation Measures

<table>
<thead>
<tr>
<th>KP</th>
<th>Location</th>
<th>Distance in km to pipeline</th>
<th>Direction of view</th>
<th>Receptor type</th>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>Outskirts of Amaxades</td>
<td>0.5</td>
<td>Viewing south towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>136</td>
<td>Kosssinthos river</td>
<td>0.66</td>
<td>Viewing north towards the pipeline</td>
<td>River</td>
<td>Medium</td>
<td>Small</td>
</tr>
<tr>
<td>137</td>
<td>Exit of Egnatia Highway to National road of Xanthi – Komotini</td>
<td>0.3</td>
<td>Viewing south towards the pipeline</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>141</td>
<td>Regional Road of Xanthi - Ziloti</td>
<td>0.1</td>
<td>Viewing north towards the pipeline</td>
<td>Road/Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>150</td>
<td>Outskirts of Pimni</td>
<td>0.01</td>
<td>Viewing south towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>152</td>
<td>Outskirts of Thalassia</td>
<td>0.06</td>
<td>Viewing west parallel to the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>154</td>
<td>Nestos River</td>
<td>0.4</td>
<td>Viewing northeast towards the pipeline</td>
<td>Nestos Crossing</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>167</td>
<td>Perni irrigation channel</td>
<td>0.15</td>
<td>Viewing east towards the pipeline</td>
<td>Irrigation Channel</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>182</td>
<td>Outskirts of Chalkero</td>
<td>0.02</td>
<td>Viewing east towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>185</td>
<td>Wildlife Refuge Agios Timotheos</td>
<td>2</td>
<td>Viewing south towards the pipeline</td>
<td>Landscape</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>195</td>
<td>Amygdaleonas village</td>
<td>3.5</td>
<td>Viewing west towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>201</td>
<td>Kokkinochoma village</td>
<td>7.5</td>
<td>Viewing north towards the pipeline</td>
<td>Landscape</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>225</td>
<td>Wildlife Refuges of Loungas- Kava-Tzikiat-Ntermentersi and Petroto</td>
<td>4.5</td>
<td>Viewing northeast towards the pipeline</td>
<td>Landscape</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>235</td>
<td>Lefkothe village</td>
<td>1.5</td>
<td>Viewing southeast towards the pipeline</td>
<td>Landscape</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>265</td>
<td>Road of Neochori - Neos Skopos</td>
<td>0</td>
<td>Viewing south towards the pipeline</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>305</td>
<td>KroussiaMountains</td>
<td>0.15</td>
<td>Viewing south towards the pipeline</td>
<td>Landscape</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>313</td>
<td>National Road of Thessaloniki – Serres</td>
<td>0</td>
<td>Viewing east towards the pipeline</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>333</td>
<td>Outskirts of Assiros</td>
<td>0</td>
<td>Viewing northeast towards the pipeline</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>358</td>
<td>Outskirts of Nea Mesimvira</td>
<td>0.5</td>
<td>Viewing north towards the pipeline</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>359.6</td>
<td>Aghialos</td>
<td>1.8</td>
<td>Viewing north towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>363.2</td>
<td>Ag. Athanasios</td>
<td>1.8</td>
<td>Viewing north towards the pipeline</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
</tbody>
</table>
### KP | Location | Distance in km to pipeline | Direction of view | Receptor type | Sensitivity | Magnitude of impact
--- | --- | --- | --- | --- | --- | ---
366.5 | Gefyra | 0.8 | Viewing north towards the pipeline | Village | Low | Small
381.0 | MikroMonastiri | 0.7 | Viewing east towards the pipeline | Village | Medium | Medium
455.5 | Antigonos | 0.15 | Viewing north towards the pipeline | Road | Low | Small
461.0 | Filotas | 0.9 | Viewing south towards the pipeline | Village | Medium | Medium
479.0 | Drosero | 0.7 | Viewing north towards the pipeline | Village | Low | Small
489.5 | Outskirts of Variko | 0.2 | Viewing north towards the pipeline | Village | Medium | Medium
492.8 | Outskirts of Kleisoura | 0.1 | Viewing south towards the pipeline | Road | High | Medium
495.0 | Verga | 0.9 | Viewing south towards the pipeline | Village | Low | Small
529.8 | Kalochori | 1 | Viewing north towards the pipeline | Village | Low | Small
533.8 | Ag. Kyriaki | 0.9 | Viewing south towards the pipeline | Village | Medium | Medium
535.0 | Outskirts of Oinoi | 0.05 | Viewing north towards the pipeline | Road | Medium | Medium
538.0 | Road between Ag. Kyriaki and Ieropigi | 2.3 | Viewing south towards the pipeline | Road | Low | Small
542.0 | Ag. Athanasios church and hilltop | 3.1 | Viewing south towards the pipeline | Church and hilltop | Low | Small
541.0 | Outskirts of Polyanemo | 3 | Viewing north towards the pipeline | Village | Low | Small
542.0 | Ieropigi | 3 | Viewing south towards the pipeline | Village | Low | Small


As can be seen from Table 8-33, the most significant impacts are associated with the view from the Kirki Wildlife Refuge at KP 50.4, crossing of Bosbozis and Nestos Rivers, and outskirts of Kleisoura at KP 492.8 (high sensitivity, medium magnitude impact), while minor to moderate significance impacts are associated with a number of other viewpoints. It should be noted however, that the impacts to viewshed during construction are temporary in nature and expected to be effectively mitigated through reinstatement.
Construction Camps

Eight (8) construction camp sites will be constructed along the pipeline length to accommodate the project personnel. They will be located in areas of low or low to medium landscape sensitivity. Given that the magnitude of impact is expected to be low and that the installations will be temporary and reinstated after Project construction, the anticipated impacts to the landscape are of minor significance.

It is noted that the final number and siting of the pipe yards will be determined by the EPC before construction begins.

<table>
<thead>
<tr>
<th>Nearest KP</th>
<th>Landscape Character Type</th>
<th>Distance in km to site (approximately)</th>
<th>Direction of view</th>
<th>Receptor type</th>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Plain agricultural areas</td>
<td>0.02</td>
<td>View to GCAMP01</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>96</td>
<td>Plain agricultural areas</td>
<td>0.8</td>
<td>View to GCAMP02</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>184</td>
<td>Mixed agricultural and urban or industrial areas</td>
<td>0.04</td>
<td>View to GCAMP03</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>254</td>
<td>Plain agricultural areas</td>
<td>0.2</td>
<td>View to GCAMP04</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>332</td>
<td>Plain agricultural areas</td>
<td>2.8</td>
<td>View to GCAMP05</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>392</td>
<td>Plain agricultural areas</td>
<td>1.2</td>
<td>View to GCAMP06</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
</tbody>
</table>

**NOTE:** Additional field visit required to establish visual receptors and sensitivity of GCAMP07 and GCAMP08.


Pipe Yards:
The current Project design foresees the construction of 17 pipe yards along the pipeline length. They will be located in agricultural land of low or low to medium sensitivity. Given that the magnitude of impact is expected to be low and that the installations will be temporary and reinstated after Project construction, the anticipated impacts to the landscape are of minor significance.

It is noted that the final number and siting of the pipe yards will be determined by the EPC before construction begins.

---

15It is noted that two more construction camps will be located within the area of each compressor station.
Table 8-35  Pipe yards - visual receptor impacts

<table>
<thead>
<tr>
<th>Nearest KP</th>
<th>Landscape Character Type</th>
<th>Distance in km to site (approximately)</th>
<th>Direction of view</th>
<th>Receptor type</th>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Plain agricultural areas</td>
<td>0.1</td>
<td>View to GPY01</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>39</td>
<td>Plain agricultural areas</td>
<td>0.06</td>
<td>View to GPY02</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>70</td>
<td>Plain agricultural areas</td>
<td>0.1</td>
<td>View to GPY03</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>100</td>
<td>Plain agricultural areas</td>
<td>0.8</td>
<td>View to GPY04</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>137</td>
<td>Plain agricultural areas</td>
<td>0.8</td>
<td>View to GPY05</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>184</td>
<td>Mixed agricultural and urban or industrial areas</td>
<td>0.5</td>
<td>View to GPY06</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>216</td>
<td>Plain agricultural areas</td>
<td>3.2</td>
<td>View to GPY07</td>
<td>Road/ Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>254</td>
<td>Plain agricultural areas</td>
<td>0.2</td>
<td>View to GPY08</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>282</td>
<td>Plain agricultural areas</td>
<td>0.15</td>
<td>View to GPY09</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>308</td>
<td>Mixed forested and agricultural areas</td>
<td>0.9</td>
<td>View to GPY10</td>
<td>Road/ Village</td>
<td>Medium</td>
<td>Small</td>
</tr>
<tr>
<td>327</td>
<td>Plain agricultural areas</td>
<td>1.8</td>
<td>View to GPY11</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>529</td>
<td>Upland agricultural areas</td>
<td>0.9</td>
<td>View to GPY17</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
</tbody>
</table>

**NOTE:** Additional field visit required to establish visual receptors and sensitivity of GPY12-GPY15.

**GPY:** Greece Pipeyard

**Source:** APROFOS (2013), EXERGIA (2013), ERM (2012)

### 8.6.2.3 Mitigation Measures

The following measures will be implemented during Project construction to mitigate the impacts presented above (presented per key impact):
8.6.2.3.1 Physical Changes to the Landscape General Unity (Fragmentation) due to Construction Works, Signs etc.

**General Mitigation Measures**

- Construction activities, outside the working strip, will be limited to the shortest practicable duration.
- All areas used for construction will be fully restored to their pre-construction state. Physical terrain, soils and vegetation will be reinstated as closely to their original condition as it is practically possible, undertaken in accordance with a *Landscape Management Plan* (refer to Section 9.3.18).
- Reducing the width of the construction corridor will be applied in forested areas to reduce magnitude of change.
- The use of existing boundary areas and landscape features (roads, fence rows, property lines, forest edges) will be sought in order to minimize visual impacts.
- Materials and machinery will be stored tidily during the works.
- Earth roads providing access to site compounds and works areas will be maintained free of dust and mud as far as reasonably practicable.
- Building structures will be designed to fit within existing topography to the extent possible.
- Construction will require the management of a substantial amount of aggregate material. In order to manage this appropriately, an *Aggregates Management Plan* will be developed (refer to Section 9.3.19).

**Specific Mitigation Measures**

A minimum working strip of 18 m (16 m plus 1 m on either side) will be used along proposed modified sections in elevated areas.

Along these sections, spare material will be disposed permanently away from the pipeline working strip. The material will preferably be transported to a dedicated area(s) as close as possible, where visual impacts can be minimised. Any disposal will be carried out on stable ground, compacted and re-naturalized (covered with local topsoil and start-up aid for habitat-suitable growth of vegetation) in order to avoid any later landslides or excessive erosion on the deposit. The shape of the spoil deposit will be profiled and landscaped in order to minimise any impact on visual amenity, in a way which is sympathetic with local topography.
Measures will be taken to protect and retain existing vegetation as outlined for the pipeline generally.

8.6.2.3.2 Disturbance of the Continuity of Landscape Habitat Features

- Avoid loss or damage to landscape features, including minimisation of vegetation clearance, particularly in environmentally sensitive areas (e.g. forest, watercourses crossings, trees that contribute to landscape setting, endangered habitat).
- Where possible, protect trees prior to construction and/or trim trees to avoid total removal. This includes vegetation that makes a significant and positive contribution to landscape character and/or has significant value in terms of diversity.
- Temporary hoardings, barriers, traffic management and signage will be removed when no longer required. Lighting of compounds and works sites will be restricted to working hours with the exception of security lighting only.
- Where the removal of vegetation landscape features is necessary, the species selected for replanting works will be appropriate and characteristic of that particular landscape area. Following completion of construction, reinstatement and planting (i.e. shrubs to stabilise the soil) along the pipeline route will be undertaken in accordance with a Landscape Management Plan (refer to Section 9.3.18).
- Include grading of earthworks to tie into the existing site contours to ensure new earthworks integrate as seamlessly as practicable with the existing landform. Integration of structural components through screen planting, use of natural materials sourced from the local area (rocks, etc.).

8.6.2.3.3 Interruption of Agricultural Activities and Use of Farmlands

- Construction activities, outside the working strip, will be limited to the shortest practicable duration.

8.6.2.3.4 Changes in the Viewshed and Aesthetic Value to Residents

- On completion of works all temporary structures, surplus materials and wastes will be completely removed.
- Removal of mature trees prior to or during construction will be minimised to that necessary for safe working.

- Above ground structures will be designed and located to be as visually unobtrusive as can be technically achieved. Where possible, provision of high quality engineering / architecture will reinforce landscape character and distinctiveness, and minimise visual intrusion.

### 8.6.2.4 Residual Impacts

Some impacts resulting from the project are unavoidable and cannot be mitigated during construction phase. The Project will alter the surrounding landscape and the visual experience of receptors. However, these changes will be seen within the context of the existing local environment. The following table presents a summary of the residual impacts following mitigation.

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measure to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| **Physical changes to the landscape general unity (fragmentation) due to construction works, signs etc.** | • Construction activities, outside the working strip, will be limited to the shortest practicable duration.  
• All areas used for construction will be restored to their pre-construction state, as close as practically feasible.  
• The width of construction corridor will be reduced when crossing forests  
• Use existing boundary areas and landscape features  
• Materials and machinery will be stored tidily during the works  
• Access roads will be maintained free of dust and mud  
• Building structures will be designed to fit within existing topography | **MODERATE**  
• In forest areas of South Forest Complex of Evros (KP 21 – 33 and 49.5 - 53.5), Wildlife Refuge of Agios Timotheos – Kiouplia (KP 187 – 190), Kroussia Mountains (KP 294-300), Vermio Mt. (KP 432 – 441), Askio Mt. and west of Kastoria |
| **Disturbance of the continuity of landscape habitats features such as the mature trees (felling of trees) or watercourses** | • Minimisation of vegetation clearance  
• Protect trees prior to construction and/or trim trees to avoid total removal  
• Temporary hoardings, barriers, traffic management and signage will be removed when no longer required  
• The species selected for replanting works will be appropriate and characteristic of that particular landscape area | **MODERATE**  
• In forest areas of South Forest Complex of Evros (KP 21 – 33 and 49.5 - 53.5), Wildlife Refuge of Agios Timotheos – Kiouplia (KP 187 – 190), Kroussia Mountains (KP 294 - 300), Vermio Mt. (KP 432 – 441), Askio Mt. and west of Kastoria |
### Project Title:
Trans Adriatic Pipeline – TAP

### Document Title:
Integrated ESIA Greece
Section 8 - Assessment of Impacts and Mitigation Measures

#### Impact / Risk | Measure to Address the Impact / Risk | Significance of Residual Impact / Risk
--- | --- | ---
**MINOR**
- Residual impacts are Minor in the remaining areas

#### Interruption of agricultural activities and use of farmlands
- Construction activities, outside the working strip, will be limited to the shortest practicable duration.

#### Changes in the viewshed and aesthetic value to residents
- On completion of works all temporary structures, surplus materials and wastes will be completely removed
- Removal of mature trees prior to or during construction will be minimised
- Screen planting
- Above ground structures will be designed and located to be as visually unobtrusive as can be technically achieved

#### Modifications in elevated areas (to be validated with field survey)
- A minimum working strip of 18 m
- Spare material will be disposed permanently away from the pipeline working strip to a dedicated area(s) as close as possible. The shape of the spoil deposit will be profiled and landscaped in order to minimise any impact on visual amenity, in a way which is sympathetic with local topography.
- Measures will be taken to protect and retain existing vegetation as outlined for the pipeline generally.

#### Source:
ASPROFOS (2013), ERM (2013)

### 8.6.3 Operation and Maintenance Phase

#### 8.6.3.1 Potential Impacts

#### 8.6.3.1.1 Permanent Presence of Project Features

Once constructed, the pipeline will be buried underground and will, with time as the farmland recovers, no longer be a source of landscape and visual impact throughout most of the pipeline corridor. The working corridor measuring up to 38 m width will present visually as a bare top soiled surface immediately following completion of construction. Farming activities will resume on
this reinstated topsoil surface. The working corridor will be a source of landscape and visual impact, until farming activities become fully established and the land recovers to become indistinguishable from the adjacent undisturbed farmed land cover. This will arise throughout most of the pipeline corridor except in some areas where permanent removal of woody vegetation will be evident as a result of the 8m wide pipeline protection strip (PPS). Impacts related to PPS will be more important in forested areas as they will create fragmentation of landscape breaking its homogeneity. However, associated impacts are considered to be less significant than those examined during construction as the safety corridor will look like a forest track or a fire fighting strip.

The block valve stations (BVS) will be present at specific locations along the route adjacent to the pipeline and will represent new and permanent elements introduced into the receiving landscape. These will be visually exposed in the working corridor.

The most affected area will be the area of the compressor station since the clearance will be in a more wide area and the buildings of the station will be quite prominent in the area. Less intrusive are the BVS, which are much smaller in size.

The introduction of the proposed structures, namely very large buildings and large hard surfaced areas associated with the compressor stations and BVS will add man-made elements, some of which are of considerable scale to the landscape establishing a new landmark feature and a point of reference in views from the wider area.

All these impacts are considered as permanent as they will remain for the whole life of the Project.

**Block Valve Stations**

The BVS are small facilities, partly installed underground, which have interference with the landscape. They are mostly installed in agricultural areas of low to medium sensitivity. As a consequence, the anticipated impacts to the landscape are of **Minor** significance.

It should be noted that two additional block valve stations will be located within the areas of the Compressor Stations (BVS GCS00 and BVS GCS01) and they are not included in the following table *(Table 8-37)*.
**Table 8-37  Block valve stations visual receptors impact**

<table>
<thead>
<tr>
<th>Approx. Chainage (KP)</th>
<th>Landscape Character Type</th>
<th>Distance in km to site (approx.)</th>
<th>Direction of view</th>
<th>Receptor type</th>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Plain agricultural areas</td>
<td>0.02</td>
<td>View to BVS01</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>42</td>
<td>Plain agricultural areas</td>
<td>0.06</td>
<td>View to BVS02</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>63</td>
<td>Hilly shrublands and grasslands</td>
<td>0.06</td>
<td>View to BVS03</td>
<td>Dirt Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>87</td>
<td>Plain agricultural areas</td>
<td>0.8</td>
<td>View to BVS04</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>113</td>
<td>Plain agricultural areas</td>
<td>2.5</td>
<td>View to BVS05</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>134</td>
<td>Plain agricultural areas</td>
<td>0.4</td>
<td>View to BVS06</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>159</td>
<td>Plain agricultural areas</td>
<td>1.6</td>
<td>View to BVS07</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>184</td>
<td>Plain agricultural areas</td>
<td>0.36</td>
<td>View to BVS08</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>209</td>
<td>Plain agricultural areas</td>
<td>0.1</td>
<td>View to BVS09</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>225</td>
<td>Plain agricultural areas</td>
<td>0.08</td>
<td>View to BVS10</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>251</td>
<td>Plain agricultural areas</td>
<td>1.1</td>
<td>View to BVS11</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>300</td>
<td>Mixed forested and agricultural areas</td>
<td>0.9</td>
<td>View to BVS12</td>
<td>Kefalochori outskirts</td>
<td>Medium</td>
<td>Small</td>
</tr>
<tr>
<td>327</td>
<td>Plain agricultural areas</td>
<td>0.2</td>
<td>View to BVS13</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>359</td>
<td>Plain agricultural areas</td>
<td>0.4</td>
<td>View to BVS14</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>375</td>
<td>Plain agricultural areas</td>
<td>0.5</td>
<td>View to BVS15</td>
<td>Village</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>394</td>
<td>Plain agricultural areas</td>
<td>0.7</td>
<td>View to BVS16</td>
<td>Road/River</td>
<td>Medium</td>
<td>Small</td>
</tr>
<tr>
<td>410</td>
<td>Plain agricultural areas</td>
<td>0.03</td>
<td>View to BVS17</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>432</td>
<td>Mountainous forested areas</td>
<td>0.3</td>
<td>View to BVS18</td>
<td>Village</td>
<td>Medium</td>
<td>Small</td>
</tr>
<tr>
<td>456</td>
<td>Upland agricultural areas</td>
<td>0.1</td>
<td>View to BVS19</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>471</td>
<td>Upland agricultural areas</td>
<td>0.08</td>
<td>View to BVS20</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>497</td>
<td>Upland agricultural areas</td>
<td>0.08</td>
<td>View to BVS21</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
<tr>
<td>529</td>
<td>Upland agricultural areas</td>
<td>0.3</td>
<td>View to BVS22</td>
<td>Road</td>
<td>Low</td>
<td>Small</td>
</tr>
</tbody>
</table>

Source: ASPROFOS (2013), ERM (2011)
Compressor Stations

Each compressor station will be an installation occupying a significant area. The entire property will cover an area of approximately 36 ha. The actual structured area will cover significantly less (approximately 8 ha) occupied with buildings like the administration building, workshop and gate house, the compressor buildings (unoccupied), a block valve station, and open gas piping areas. Stacks in the complex are expected to be placed 3 m above existing ground level and reach a height of 30 m, while the vent stack, located at the opposite end of the site and at a sufficient distance to occupied buildings, will reach a height of 70 m. A typical layout of a compressor station is shown in Figure 8-5 (for further details on the layout of the compressor station see Section 4 and its Annexes).

Figure 8-5 Typical Compressor Station Layout

Source: TAP (2012) Compressor Station 3D Illustrative Layout

Note: Final heights will be determined by the EPC Contractor during the ongoing design of the project and are subject to modifications.
Compressor Station GCS00

The proposed site of GCS00 is located in the Landscape Character Type «Plain agricultural areas». The sensitivity of the particular character type is generally low.

The magnitude of the impact is assessed by calculating the Zone of Visual Influence (ZVI) for the facility (Figure 8-7) [an A3 version of the ZVI is presented in Annex 6.6.4, Supplement II and photomontages of the built GCS00 facility from three viewpoints in proximity to the site are given in Annex 6.6.4, Supplement III]. The ZVI is illustrated in map format and it was calculated digitally and based on the local topography and the height of the structures, without considering any visual screening provided by vegetation or buildings. The ZVI map has been differentiated by structures in a way that it presents a different visibility area for the vent, the stack and the buildings. The 70 m high vent is visible (although a very slim and isolated structure) from a greater area which includes most of the surrounding villages. The visibility of the stack and the buildings differs and, due to the hilly morphology of the area, includes only the surrounding villages of Tavri and Thymaria which are more than two and a half kilometres distance from the facilities of GCS00. Overall, the magnitude of the impact is considered low and the resulting impact significance Low.

Table 8-38  GCS00 compressor station visual receptors sensitivity

<table>
<thead>
<tr>
<th>Viewpoint</th>
<th>Distance in km to nearest site boundary (approx.)</th>
<th>Direction of view</th>
<th>Receptor type</th>
<th>Sensitivity</th>
<th>Magnitude of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP-8-E</td>
<td>2.6</td>
<td>West view of the GCS location</td>
<td>Village</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>VP-2-E</td>
<td>0.5</td>
<td>Southeast view of the GCS location</td>
<td>Road</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>VP-57-E</td>
<td>2.1</td>
<td>Southwest view of the GCS location</td>
<td>Village</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>VP-4-E</td>
<td>0.2</td>
<td>Northeast view of the GCS location</td>
<td>Road</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>VP-8-E</td>
<td>2.6</td>
<td>West view of the GCS location</td>
<td>Village</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: EXERGIA (2013)
Figure 8-6  Photomontage of South view of GCS00 location

Existing view

Future view after implementation

Source: EXERGIA/ ENT (2013)
Figure 8-7  Zone of Visual Influence (ZVI) for GCS00

Source: EXERGIA (2013). Notes: 1. An A3 version of the ZVI is presented in Annex 6.6.4, Supplement II. 2. Areas where vent is visible in orange; areas where stack is visible in green; areas where buildings are visible in blue.
Compressor Station GCS01

The proposed site of GCS01 is located in the Landscape Character Type «Plain agricultural areas». The sensitivity of the particular character type is low to medium.

Similar to what described for GCS00, the magnitude of the impact is assessed by calculating the Zone of Visual Influence (ZVI) for the facility (Figure 8-7) [an A3 version of the ZVI is presented in Annex 6.6.4, Supplement II and photomontages of the built GCS01 facility from three viewpoints in proximity to the site are given in Annex 6.6.4, Supplement III].

The 70 m high vent is visible (although a very slim and isolated structure) from a greater area which includes most of the surrounding villages. The visibility of the stack and the buildings includes, also, all the surrounding villages. The flat characteristics of the broader area morphology provide almost no screening of the station’s features. All settlements in the broader area are located at a distance of more than 1.5 km from the boundaries of GCS01. Overall, the magnitude of the impact is considered low and the resulting impact significance low.

Table 8-39  GCS01 compressor station visual receptors sensitivity

<table>
<thead>
<tr>
<th>Viewpoint</th>
<th>Distance in km to nearest site boundary (approx.)</th>
<th>Direction of view</th>
<th>Receptor type</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP-E-GCS01_N(1)</td>
<td>1</td>
<td>North view of the CS location</td>
<td>Road/ Village</td>
<td>Low</td>
</tr>
<tr>
<td>VP-E-GCS01_NE(3)</td>
<td>1.2</td>
<td>North-East view of the CS location</td>
<td>Road</td>
<td>Low</td>
</tr>
<tr>
<td>VP-E-GCS01_SE(4)</td>
<td>2.6</td>
<td>South-East view of the CS location</td>
<td>Village</td>
<td>Low</td>
</tr>
<tr>
<td>VP-E-GCS01_S(8)</td>
<td>2</td>
<td>South view of the CS location</td>
<td>Village</td>
<td>Low</td>
</tr>
<tr>
<td>VP-E-GCS01_SW(5)</td>
<td>1.2</td>
<td>Southwest view of the CS location</td>
<td>Road/ Village</td>
<td>Medium</td>
</tr>
<tr>
<td>VP-E-GCS01_NW(6)</td>
<td>1.2</td>
<td>North-West view of the CS location</td>
<td>Road</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: ASPROFOS (2013)
Project Title: Trans Adriatic Pipeline – TAP
Document Title: Integrated ESIA Greece
Section 8 - Assessment of Impacts and Mitigation Measures

Figure 8-8 Photomontage of Northwest view of GCS01

Existing view

Future view after implementation

Source: ASPROFOS/ ENT (2013)
Source: ASPROFOS (2013) Notes: 1. An A3 version of the ZVI is presented in Annex 6.6.4, Supplement II. 2. Areas where vent is visible in orange; areas where stack is visible in green; areas where buildings are visible in blue.
Modification to elevated areas

Alterations to the topography along the elevated areas during construction will remain as permanent features to the local landscapes of these sections along the pipeline route. However, restoration and revegetation will eventually naturalise these sections into the landscape over time.

A 6 m wide permanent access road will remain after reinstatement of the elevated areas for maintenance during Project operation, as shown in Annex 3.6 Technical Drawings - Work Strip, Construction Methods and Crossing.

Additional field survey work will be required to establish the visual receptors and sensitivity of the specific modified sections.

8.6.3.2 Mitigation Measures

The following mitigation measures will be applied:

- Appropriate lighting design to minimise light spill
  - Use of specifically designed lighting equipment that minimises the upward spread of light or glare towards receptors.
  - The use of vegetation screening to assist in providing a perception of light while also contributing to a visual and landscape response.

- Access and integration of access roads into the local landscape through sensitive earthworks to reduce visibility.

- Reinstate vegetation within working strip (except for the 8 m PPS), especially in forested areas, with suitable species. Within the 8 m PPS, no deep rooted species are allowed but otherwise, shallow rooted species, may be planted.

- The 8 m PPS may be used as a fire belt by the competent forest authorities, if deemed appropriate.

- Both Compressor Stations will have a building design (including the use of proper materials and colours) that will allow them to blend with the landscape as much as possible.
A vegetation screen alongside the compressor station and block valve stations parcels will be provided to reduce visual impacts in the long term (subject to the results of the QRA regarding safety distances).

8.6.3.3 Residual Impacts

Initially, the permanent pipeline features, and especially the compressor station, will have an impact upon the viewing experience of the visual receptors. The visual amenity of the area will be, in parts, affected by the Project intruding upon views. Residential receptors, outdoor recreation facility users and road users will experience the most significant changes due to their respective viewing opportunities and proximity to the Project.

However, the Project features will become less dominant over time as they will become part of the landscape and views as vegetation naturally regenerates, or screening vegetation matures.

During the operational lifetime of the Project, construction restoration earthworks performed along the temporary working strip of the modified sections in elevated areas will reinstate topsoil and, where possible, vegetation covers. Reinstatement will take place in a way that vegetation (e.g. grass) can grow along the PPS (8 m) and around the permanent 6 m maintenance access road.

Whilst mitigation planting is proposed in these areas, this may establish and grow very slowly during the operational phase, and in some areas it may not establish at all. This is as a result of the higher elevations, thin soil cover and the steep sided slopes associated with these sections.

The following table presents a summary of the residual impact associated to the impacts identified.
### Table 8-40 Residual Impacts – Landscape and Visual Amenity – Operations Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operation Phase</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Permanent Presence of BVS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Appropriate lighting design to minimise light spill</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Use of specifically designed lighting equipment that minimises the upward spread of light or glare towards receptors.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Use of vegetation screening to assist in providing a perception of light while also contributing to a visual and landscape response.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Access and integration of access roads into the local landscape through sensitive earthworks to reduce visibility.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Reinstate vegetation within working strip (except for 8 m PPS), especially in forested areas.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MINOR</strong></td>
<td></td>
</tr>
<tr>
<td><em>The scale of the permanent change is small relative to the scale of the landscape affected for all BVS planned</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Permanent Presence of GCS00 and GCS01</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• It is foreseen to use a building design that will blend with the landscape as much as possible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Provide a vegetation screen alongside the compressor stations parcels to reduce visual impacts in the long term (subject to the results of the QRA regarding safety distances).</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MODERATE</strong></td>
<td></td>
</tr>
<tr>
<td><em>The building structure and the stack stand out in the landscape</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Maintenance of the 8m wide PPS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Reinstate vegetation within working strip (except for the 8 m PPS), especially in forested areas, with suitable species. Within the 8 m PPS only shallow rooting species, may be planted.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The 8 m PPS may be used as a fire belt by the competent forest authorities, if deemed appropriate.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MODERATE</strong></td>
<td></td>
</tr>
<tr>
<td><em>In forested areas, the PPS will remain visible. These areas include: South Forest Complex of Evros (KP 21 – 33 and 49.5 53.5), Wildlife Refuge of Agios Timotheos – Kioupi (KP 187 – 190), Kroussia Mountains (KP 303 – 307), Vermio Mt. (KP 433.6-442.8 inclu. modified sections in elevated areas), Askio Mt. (KP 491.4 – 495.5 inclu. modified sections in elevated areas) and west of Kastoria (535.9 – 543 inclu. modified sections in elevated areas)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>NOT SIGNIFICANT</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>In agricultural lands PPS will be reinstated to previous uses and no impact will remain.</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.6.4 Decommissioning Phase

8.6.4.1 Potential Impacts

8.6.4.1.1 Permanent Loss of Some Landscape Elements/ Features

The decommissioning phase will create minor impacts to the visual amenity of the landscape. Although all the necessary reinstatement activities will take place, permanent loss of some floristic landscape features (vegetation, mature trees, and riparian natural vegetation) is inevitable.

8.6.4.1.2 Disturbance of the Landscape Unity by Demobilization and Abandonment of Facilities and Infrastructure

Activities for the demobilization and abandonment of facilities and infrastructure will impose some disturbance in the overall landscape character. Nevertheless, this is likely to be minor and temporal.

8.6.4.2 Mitigation Measures

- Vegetation rehabilitation, replacement planting and encouragement of natural regeneration to the pipeline corridor and around the permanent buildings. This will optimise visual protection of receptors from above ground structures. New planting will consider appropriateness to local character and to enhance local biodiversity and habitat value. At post completion, the permanent buildings can be partly screened by a belt of new woodland edge planting. The magnitude of change is considered to be moderate and the effect to be moderate beneficial.

- Roads providing access to site compounds and works areas will be maintained free of dust and mud as far as reasonably practicable.

- Removal of permanent structures, such as Compressor Stations and BVSs. Nevertheless, this should be subject to special study prior to decommissioning works commencement. This is due to the fact that future, unforeseen at the present moment, developments and uses of such structures may be applicable at the time of decommissioning.
8.6.4.3 Residual Impacts

During decommissioning the impacts that are significant and cannot be mitigated entirely are mostly related to the compressor station area. There the surrounding landscape and the visual experience of receptors will be altered, through the removal of buildings that are technically feasible to be removed. However, these changes will be seen within the context of the existing local environment. Table 8-41 presents a summary of the residual impacts associated with the impacts identified.

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decommissioning Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permanent loss of some landscape elements/features</td>
<td>• Vegetation rehabilitation, replacement planting and encouragement of natural regeneration</td>
<td>MODERATE</td>
</tr>
<tr>
<td></td>
<td>• The magnitude of change is considered to be moderate and the effect moderate beneficial.</td>
<td></td>
</tr>
<tr>
<td>Disturbance of the landscape unity by demobilization and abandonment of facilities and infrastructure</td>
<td>• Roads providing access to site compounds and works areas will be maintained free of dust and mud as far as reasonably practicable</td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>• The effect is minor and temporal.</td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012)

It is highlighted that impacts during decommissioning cannot be entirely assessed at the present moment. This is due to the significant time lap (of at least 50 years) between the period preparing the present assessment and the future when the actual decommissioning will take place. At the time of decommissioning it is possible that the needs of the local community and the available engineering solutions are totally different than the ones presently known. Consequently, buildings instead of removed may be used for other purposes, whilst recycling of materials and equipment may be further developed to include all project components. In order to address all these uncertainties, a special assessment should be prepared at the time of decommissioning.

8.6.5 Summary of Impacts on Landscape and Visual Amenity

*Construction and Pre-Commissioning Phase:*

The 543 km long pipeline section in Greece will be buried in the ground and will therefore as a feature itself not be visible. Construction activities, especially the working strip itself will be visible
during several months of construction. Project construction activities will create temporary impacts primarily related to the visual appearance of the works, and resulting in fragmentation of the landscape, disturbance of its habitats’ features continuity. All these will be greater on the most sensitive landscapes such as forested areas and narrow valleys, where a reduced working strip will be adopted where practicable.

The adoption of trenchless construction techniques to cross some rivers of high landscape value, such as Filliorus, Nestos and Axios will contribute to avoid impacting the continuity of the landscape features affected, as the loss of riparian forest at the crossing points.

Significant impacts to the aesthetic value for residents are associated to the village of Kleisoura where a community afforestation area will be affected by vegetation clearance for the pipeline construction. Also, visitors to the Wildlife Refuges of Kirki and of Agios Timotheos – Kioupia could experience some impacts on the landscape value. To address these impacts, mitigation measures such as reducing the width of the working strip, immediate reinstatement to the maximum extent possible, usage of existing landscape features and best industry practices will be implemented. The construction camps and pipe yards will impact to receptors of the landscape value in neighbouring villages and roads. However their studied location in low sensitivity landscapes reduces the magnitude of the impact.

Seven elevated sections, totalling up to approximately 21 km (subject to further engineering planning), will be modified along the pipeline route from the eastern extent of the Vermio Mountain slopes to the Albanian border. On these sections, modification will provide a minimum 18 m wide construction platform. Cut material will be deposited at suitable slopes and landscaped. It is noted that a reduction of the elevation of an area’s morphology by few metres is visually irrelevant when seen from a long distance. Additional field survey work will be required to produce a view shed analysis and photomontages and assess the significance of any visual impacts along these sections

**Operation and Maintenance Phase:**
Landscape impacts during the operations phase will be related to the permanent above-ground structures, as the compressor stations GCS00 and GCS01 and the BVSs, and further to the maintenance of the 8m wide pipeline protection strip.
Most prominently the compressor stations, each one with a building height of about 15 m, and with 5 stacks of about 30 m and a 70 m high vent each, will be visible. According to the view shed analysis undertaken, the installations will remain visible from the distance including surrounding villages which are at distances greater than 1.2 km.

The adoption of vegetation screens composed of trees around and in the vicinity of the stations, the use of material and colours that help the structures blend with the landscape and the adoption of specific designed lighting together with the location on an agricultural landscape will help reducing the visual impact and landscape disturbance of the structures.

The foreseen approximately 22 BVSs along the route are relatively small sized features with mainly underground installations and therefore minor impacts on the landscape are predicted.

Typically, the pipeline route will be integrated into the landscape within a few years after site restoration. Still the pipeline route will remain visible in the landscape as a narrow corridor where it crosses woody vegetation and permanent plantations such as orchards and vineyards, as the pipeline protection strip of 8 m width must be kept free from woody vegetation. In forested areas, this strip could be used as a fire fighting strip. This corridor would mainly be visible from a distance, in particular from where the pipeline route is running on wooded slopes.

**Decommissioning Phase:**

With a design pipeline life of 50 years, it is currently uncertain which decommissioning approach will be adopted at the end of the Project lifetime. Current international best practice is to leave a pipeline in the ground (abandonment-in-place), and secure it against structural collapse, in which case impacts on the landscape will be minimal. A possible dismantling of permanent Project facilities (compressor stations, block valve stations) would cause some disturbance in the overall landscape character, however, with the implementation of the appropriate mitigation measures such impacts are considered of minor significance.
8.7 Terrestrial Ecology

8.7.1 Overview

During the development of the pipeline route, the Project has sought to avoid, minimise and mitigate impacts on biodiversity in line with the EBRD PR6 and IFC PS6 (refer to Annex 5.7 for assessment criteria) through the options appraisal, route-refinement and final assessment.

Box8-6 presents the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the Project on terrestrial ecology.

<table>
<thead>
<tr>
<th>Sources of Impact/Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction phase: Movement of Vehicles, Equipment, and Personnel; Upgrade of existing roads for access; Preparation of the Working Strip (topsoil removal, vegetation clearance); Backfilling and reinstatement of pipeline trench and temporarily disturbed land from construction; River crossings; Construction of temporary facilities (camps and yards), Compressor Stations and BVS, Operation of construction camps</td>
</tr>
<tr>
<td>Operation and maintenance phase: Movement of Vehicles, Equipment, and Personnel; Maintenance of the 8 m wide protection strip; Noise and light from Compressor Stations and BVS</td>
</tr>
<tr>
<td>Decommissioning phase: Movement of vehicles, equipment and personnel</td>
</tr>
</tbody>
</table>

Potentially Impacted Resources and Receptors

- Flora, fauna and habitats

Particular Baseline Conditions that are Potentially Influencing Impacts/Risks

- Remote areas with no current access
- Current population ranges

Project Factors that are Potentially Influencing Impacts/Risks

- Construction camp management, waste management, traffic management, timing of works, river crossing techniques, level of physical contamination (i.e. noise, light, etc.)

References

- Baseline is found in Section 6.3.2 and 6.3.3. Impact Assessment Criteria is found in Annex 5.7. Monitoring Measures are described in Section 9.2.

Source: ERM (2012)

The following table presents the key potential impacts of the Project on terrestrial ecology during the key phases.
In the following Sections, each potential impact has been discussed giving information on how each source is likely to have an impact on receptors and the mitigation measures inbuilt within the Project.

8.7.2 Construction and Pre-commissioning Phase

8.7.2.1 Potential Impacts

8.7.2.1.1 Flora Habitat Loss

The estimations regarding the construction impact assessment on habitat loss (vegetation in particular) indicate that the temporary land take concerning 92/43/EEC habitats is 6% of the total pipeline land take for a regular working strip of 38 m wide, and 18% when considering also the Greek habitat types. This relatively small percentage reflects the fact that the pipeline mostly crosses agricultural land and few shrubland areas. Among the different Annex I habitat types, the largest land uptake is planned to occur within 6420 (i.e. Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion) which are generally widespread in the area comprising 3% of the landscape, with 9540 - Mediterranean Pine forests with the endemic Mesogean Pines which comprises 2% of the land uptake and the rest of the habitats comprising less than 1%. Among the different Greek habitat types, the largest land uptake is planned to occur within thermophilous oak forests (4%) which are generally widespread in the area, with pseudomaquis comprising 3% of the land uptake and the rest of the habitats comprising less than 1%.

The temporary land uptake is reduced by approximately 26% in cases where a reduced working strip is selected.

1) 2064 ha
Habitat loss during construction will involve one 92/43/EEC priority habitat recorded within the study area, the riparian alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (91E0). This habitat is extremely rare in Greece: alluvial forests occur on heavy soils (generally rich in alluvial deposits) periodically inundated by the annual rise of the water level, but otherwise well-drained and aerated during low-water and they constitute a European priority habitat (Dafis et al., 2001; EC, 2007). In Greece they occur scattered and as remnants, and are rare and dominated by *Alnus glutinosa* (Dafis et al., 2001; Dimopoulos et al., 2006). In the study area, alluvial riparian forests were recorded along small streams approximately at KP 494.7 near Kleisoura and KP 532.3 at the Aliakmonas River crossings. *Alnus glutinosa* and *Fraxinus excelsior* (91E0) habitat is recorded also at KP 521.4 but without being crossed, since it lies at a distance of 60 m from the pipeline.

One additional 92/43/EEC priority habitat recorded is the 3170 (i.e. Mediterranean temporary ponds), usually found in small patches and stagnant waters of low depth (KP 113 and KP 437.9 to 438.3), although it is not crossed by the proposed pipeline route. This habitat type was expected to be present on the area of Nestos river according to the Natura 2000 datasheet (but during the fieldwork carried out in the present study the habitat type was not recorded) and was found during the field survey in the area of Kompatsos river in very small stands (of 1 - 2 m²) and in one location in Vermio mountains. The data for the Natura site of Nestos River (GR1150010 and GR1150001) gives an extremely small coverage of this habitat type. Their ephemeral nature and small size regularly create difficulties in terms of their exact delineation. In any case, the habitat type will not be affected by the construction of the pipeline: in Kompatsos River, the recorded site is located at 100 m distance from the pipeline, while in Nestos River the sites are known to be located outside the construction zone of the proposed pipeline. In Vermio the section identified lies on the edge of the working strip. Nevertheless, pre-construction verification is deemed necessary to ensure the habitat will not be affected.
### Table 8-43  Total area of European Priority Habitat\(^1\) loss during construction

<table>
<thead>
<tr>
<th>Code of habitats 92/43/EEC</th>
<th>Habits 92/43/EEC</th>
<th>Approximate location along the pipeline</th>
<th>Total area of habitat loss during construction (ha):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>regular working strip (38 m)</td>
</tr>
<tr>
<td>91E0 Alluvial forests with Alnus glutinosa and Fraxinus excelsior</td>
<td>KP 494.7</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>KP 521.4</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Aliakmonas River I crossing point)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KP 532.3</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Aliakmonas River III crossing point)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3170 Mediterranean temporary ponds</td>
<td>KP 112.9</td>
<td>No impacts are anticipated as a trenchless crossing technique will be performed. Also the habitat was recorded during the field survey at a distance of 100 m from the pipeline. Location close to the pipeline is not expected to be affected but due to the temporary nature of this habitat it could be affected. In such cases local route optimisation will be performed in order to avoid any impact.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>KP 437.9 to 438.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^*\) The specific area of the habitat is located at approx. 60 m from the pipeline so this area is not going to be affected.

Source: ERM (2012), ASPROFOS (2013)

For other habitats, including European and Greek habitats, as well as other vegetation types, land uptake is presented in Table 8-44.

### Table 8-44  Total Area of Habitat Loss (excluding European Priority Habitats) during Construction

<table>
<thead>
<tr>
<th>Habitat or Land Cover Code</th>
<th>Habitats or Land Cover Name</th>
<th>Approximate location along the pipeline</th>
<th>Total minimum area of habitat loss during construction (ha):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>regular working strip (38m)</td>
</tr>
<tr>
<td>1020 Cultivations</td>
<td>Most of the pipeline</td>
<td>1,637.00</td>
<td>1,206.98</td>
</tr>
<tr>
<td>1030 Reforestations</td>
<td>KP 233,5, KP 243,5, KP 290-290,5</td>
<td>1.85</td>
<td>1.39</td>
</tr>
<tr>
<td>1050 Urbanized areas</td>
<td>Several</td>
<td>2.39</td>
<td>1.67</td>
</tr>
<tr>
<td>1061 Unvegetated sand beds</td>
<td>Several</td>
<td>0.94</td>
<td>0.68</td>
</tr>
<tr>
<td>3190 Lakes of gypsum karst</td>
<td>KP 304, KP 313, KP 320</td>
<td>0.17</td>
<td>0.13</td>
</tr>
</tbody>
</table>

\(^1\) Only reported for Annex I, 92/43 EE priority habitats certified to exist within the 500m pipeline corridor
<table>
<thead>
<tr>
<th>Habitat or Land Cover Code</th>
<th>Habitats or Land Cover Name</th>
<th>Approximate location along the pipeline</th>
<th>Total minimum area of habitat loss during construction (ha):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>regular working strip (38m)</td>
</tr>
<tr>
<td>3280</td>
<td>Constantly flowing Mediterranean rivers with <em>Paspalo-agrostidion</em> species and hanging curtains of <em>Salix</em> and <em>Populus alba</em></td>
<td>Filiouris River (KP 77.5), Kompasatos River (KP 113), Kossinthsos River (KP 136), Nestos River (KP 154), Axios River (KP 370.1 to 370.2)</td>
<td>1.58</td>
</tr>
<tr>
<td>32B0</td>
<td>Annual river mud communities</td>
<td>Kompasatos river KP 112–113, Nestos river KP 154</td>
<td>0.32</td>
</tr>
<tr>
<td>5160</td>
<td>South-eastern Mediterranean deciduous thickets</td>
<td>Several (see Section 6.3.2.2 and Annex 4.1)</td>
<td>19.59</td>
</tr>
<tr>
<td>5210</td>
<td>Arborescent matorral with <em>Juniperus</em> spp.</td>
<td>Vermio Mt., Kastoria to Border (KP 442.0 to 442.7, KP 445.0 to 445.1, KP 445.3 to 445.4, KP 445.5 to 445.7, KP 535.9 to 537.2)</td>
<td>6.75</td>
</tr>
<tr>
<td>5340</td>
<td>Garrigues of eastern Mediterranean</td>
<td>KP 42 to 43, KP 44 to 46, KP 46.5 to 47.5, KP 182.3 to 184.5</td>
<td>14.52</td>
</tr>
<tr>
<td>5350</td>
<td>Pseudomaquis</td>
<td>KP 58.5 to 62, KP 62.5, KP 177.5 to 178.5, KP 181 to 183, KP 186 to 193, KP 284, KP 295, KP 295 to 311, KP 346, KP 349, KP 352 to 354</td>
<td>64.61</td>
</tr>
<tr>
<td>6210</td>
<td>Semi-natural dry grasslands and scrubland facies on calcareous substrates <em>(Festuco-Brometalia)</em></td>
<td>Askion Mt. (KP 491.6 to 492.3, KP 492.6 to 493.8)</td>
<td>6.00</td>
</tr>
<tr>
<td>6290</td>
<td>Mediterranean subnitrophilous grasslands</td>
<td>Several (see Section 6.3.2.2 and Annex 4.1)</td>
<td>54.06</td>
</tr>
<tr>
<td>62A0</td>
<td>Eastern sub-mediterranean dry grasslands</td>
<td>Several</td>
<td>42.8</td>
</tr>
<tr>
<td>6420</td>
<td>Mediterranean tall humid herb grasslands of the <em>Molinio-Holoschoenion</em></td>
<td>KP 171 to 172, KP 345.5, KP 355.5, KP 437.0 to 439.0</td>
<td>50.20</td>
</tr>
<tr>
<td>Habitat or Land Cover Code</td>
<td>Habitats or Land Cover Name</td>
<td>Approximate location along the pipeline</td>
<td>Total minimum area of habitat loss during construction (ha):</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------------------------------------------</td>
<td>----------------------------------------</td>
<td>--------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>regular working strip (38m)</td>
</tr>
<tr>
<td>6450</td>
<td>Greek hyper-mediterranean humid grasslands</td>
<td>KP 120, KP 138.5, KP 158 to 159.5, KP 257.5, KP 281.5, KP 290 to KP 291, KP 238, KP 257.5, KP 281.5, KP 290 to 291</td>
<td>4.58</td>
</tr>
<tr>
<td>72A0</td>
<td>Reeds</td>
<td>Several areas (Komotini – Xanthi plain, southern Evros)</td>
<td>1.68</td>
</tr>
<tr>
<td>8210</td>
<td>Calcereous rocky slopes</td>
<td>KP 353.5</td>
<td>0.08</td>
</tr>
<tr>
<td>9130</td>
<td>Asperulo-Fagetum beech forests</td>
<td>Vermio Mt., Eordea plain (Kleisoura) (KP 433.5 to 437.0, KP 438.8 to 440.2, KP 440.7 to 441.2, KP 492.8 to 494.9)</td>
<td>12.65</td>
</tr>
<tr>
<td>924A</td>
<td>Thermophilous oak woods of E Mediterranean and Balkans</td>
<td>Several (see Section 6.3.2.2 and Annex 4.1)</td>
<td>86.34</td>
</tr>
<tr>
<td>9250</td>
<td>Quercus trojana woods</td>
<td>KP 190-191, KP 295.5 to 297, KP 431.8 to 432.4, KP 445.0 to 445.6, KP 452.7 to 453.5</td>
<td>5.20</td>
</tr>
<tr>
<td>92A0</td>
<td>Salix alba and Populus alba galleries</td>
<td>Several (see Section 6.3.2.2 and Annex 4.1)</td>
<td>10.64</td>
</tr>
<tr>
<td>92C0</td>
<td>Platanus orientalis and Liquidambar orientalis woods</td>
<td>KP 27, KP 179, KP 237, KP 238, KP 240.5, KP 443.4 to 444.0, KP 448.1 to 448.6</td>
<td>1.79</td>
</tr>
<tr>
<td>9350</td>
<td>Quercus macrolepis forest</td>
<td>KP 38, KP 57.5 to 58.5</td>
<td>5.20</td>
</tr>
<tr>
<td>9540</td>
<td>Mediterranean pine forests with endemic Mesogean pines</td>
<td>KP 27 to 27.5, KP 28.5 to 31.5, KP 49.5 to 51.25, KP 53 to 55.5</td>
<td>29.81</td>
</tr>
</tbody>
</table>

Description

- European Habitat Directive
- Greek Habitats
- Other land cover

Source: ASPROFOS (2013), ERM (2013)
Construction activities along the route will pose some fire risk to habitats, especially in the vicinity of densely vegetated areas during the drier summer months. Although risks will be minimised through general good site management and working practices, there is a possibility that fires could be ignited from such activities as welding or the improper discarding of lit cigarettes by workers. The low-altitude plains e.g. Komotini – Xanthi (KP 86 – 176), Filippoi Plain (KP 193 – 225), Serres Plain (KP 225-296), Gallikos Plain (KP 329-359), Axios Plain (KP 359- 425), Ptolemaida Basin (KP 466 – 486) where agricultural crop cover is prominent, the pine forests of southern Evros as well as dense forests at higher altitude sites (e.g. Kroussia Mountains at KP 295 – 329, Vermio Mountain slopes at KP 425- 441, and Kleisoura at KP 492-496), will be amongst the most susceptible sections along the pipeline route.

Overall, it can be seen from the analysis above that the impacts related to habitat loss are of relatively small magnitude as the area affected comprises mainly agricultural land. Where 92/43/EEC habitats are indeed affected the sensitivity of the habitats is considered to be medium as they are rather widespread in the area. Exceptions are the a) riparian alluvial forest (91E0) at Kleisoura area and Aliakmonas River, and b) Mediterranean temporary ponds (3170) 92/43/EEC priority habitat types. The magnitude of the impact on habitat 91E0 is small but the riparian alluvial forest habitat type is extremely rare in Greece and therefore its sensitivity is high. Assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact should be assessed as being MODERATE. Residual impact, after the implementation of the mitigation measures is summarized in the Section 8.7.2.3.

Regarding the Mediterranean temporary ponds habitat type, a trenchless construction technique will be performed for the crossing of Kompsatos River avoiding direct intervention in the specific habitat type, which in addition is located at a distance of approximately 100 m from the pipeline. Nevertheless, due to the temporary and dynamic character of the habitat, micro-siting of the pipeline route could be required to avoid any impacts (within 500m corridor). Magnitude of the impact is small but the sensitivity of the habitat is high. Assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact should be assessed as being minor. Residual impact, after the implementation of the mitigation measures is summarized in the Section 8.7.2.3.
8.7.2.1.2 Fauna Habitat Fragmentation

Habitat fragmentation imposed during construction (and maintained during operation) at certain sections along the route including the breach of isolation and the subsequent edge effects are most likely to affect large mammals such as the wolf (*Canis lupus*) and Jackal (*Canis aureus*). Potential impacts on Bear (*Ursus arctos*) from the overall project activities, including habitat fragmentation, are presented in Section 8.7.2.1.4.

**Wolves**

Wolves are characterized by ecological plasticity due to their high mobility, relatively high reproduction potential and the opportunistic nature of their foraging techniques (Carroll et al., 1999). However, like any other mammal species they need two basic elements to survive, reproduce and eventually to gradually disperse away from their territories: a) Safe reproduction areas where the years’ offspring (wolf pups) are protected from natural predators, humans and dogs; b) Adequate food supply especially during the reproduction period. Wolves in Greece may move even 50 km per day while seeking prey, although daily distance travelled averages 12-25 km depending on the wolf’s sex and season (Iliopoulos, 2010). High mobility permits wolves to easily overcome movement obstacles like artificial lakes, or select the most suitable sites to cross rivers or other natural or human barriers as observed recently with the use of satellite telemetry (Iliopoulos et al, 2005, 2008, 2009, 2010, 2010b). As a result, although the Project will have minimal impact on the wolf’s regular movements, foraging and dispersal, the most stationary phase of the wolf pack annual cycle, that is the breeding period, could be affected by the TAP construction and operation phase.

The crucial factors regarding selection of home sites in wolves are avoidance of even low traffic forest roads, proximity to water sources and selection of less fragmented forest patches. Moreover, wolves are generally sensitive to disturbance close to home sites: even low use forest roads close to home sites or even trails may cause wolves to abandon an area if used by humans on foot during recreation activities and hunting, independently from vehicle use. The

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1 For example wolves in Grevena region, northern Greece, frequently crossed Egnatia highway construction zone (segment 4.1) characterized by extended earth works, large embankments and noisy construction sites although wolves crossed Egnatia works significantly faster and had been more nocturnal where crossings had been provided (Iliopoulos, 2009, 2010).

2 Gehring (1995) investigated five den sites in northwestern Wisconsin and found them nearly twice the distance from roads and trails (x= 740 m) than randomly selected sites (x= 300 m). Unger (1999) and Keenlance (2002) both found that wolves in northern Wisconsin most often selected den sites in the centers of their territories and in areas of lower road density. Reduced forest fragmentation was also a critical factor for wolves in Poland when selecting their home sites as probability of use was disproportional to its distance from forest edges (Theuerkauf et al., 2003). Avoidance of forest roads by wolves when selecting homesite was also
degree to which human disturbance may influence wolf home sites probably varies according to the environmental context: if a particular habitat is highly attractive, wolves can tolerate disturbance by humans, at least within some limits (Paquet et al. 1996). However, when the degree of disturbance increases wolves tend to ignore any favourable characteristic of the home site and abandon the area1.

In Greece the reported average distance from forest roads as a potential source of disturbance was found to be 350-400 m, with 65% of the home sites at distances >300 m, (Iliopoulos, 2010). During a case study on the response of a wolf pack having its territory inside the construction area of Egnatia highway in northern Greece, it was found that although wolves frequently crossed the construction zone, the home site was at a distance of 1,000 m away from the alignment of the road, while any temporal daytime resting sites were at distances of more than 500 m, (Iliopoulos, 2009). Researchers from Sweden (Karlsson, 2007) have reached similar conclusions.

Wolves generally avoid forest clear cuts and roads, but do tolerate intense disturbances, such as human presence for a short duration. In Canada during an experimental disturbance close to active dens (i.e. approaching of researchers) researchers found that in 50% of the dens handled, wolves moved young wolf pups and abandoned the main den. Eventually wolves reused the sites the next year as the amount and duration of disturbance was a low impacted one and lasted only 3 days without altering the surrounding habitat. Researchers suggested that pups are most vulnerable early in the year when less mobile; therefore, managers should consider age of pups before human activity at or near wolf home sites occurs (Frame et al, 2007). Chapman (1977) recommended prohibiting major disturbance within a 2.4 km radius of home sites. The US Forest Service has guidelines in the Tongass Land Management Plan revision that calls for 400 m forested buffers around active wolf dens (Paquet and Darimont, 2002). In the Rocky Mountain National Parks (Banff, Kootenay, Jasper, and Yoho) and Alberta Provincial Parks, human activities such as hiking, which are far less disturbing than logging or road-pipeline construction, are forbidden within a 1.6 km radius of wolf home sites. Regulations governing wolf reintroduction to Yellowstone National Park restrict human visits to 1.6 km around active home sites (Fritts et al. 

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1 Kumar and Habib (2007) in India found that wolves abandoned their dens by shifting wolf pups in nearby auxiliary dens, but this was less probable when home sites were closer to water (valuable resource) or when the pups were too young (less than 1 month) and so very difficult to move by themselves. Disturbance in that case was increasing relatively to the proximity of human and livestock. Person and Ingle (1995) reported that a wolf pack in southeast Alaska abandoned a den area shortly after road building activity near the den began in July 1993 and the affected pack significantly reduced their year-round activity in the entire valley. In general the severity and continuity of disturbance might also be the most critical factors determining the possibility of abandoning the home sites (Paquet and Darimont, 2002).
1994). Paquet and Darimont (2002) proposed a complete prohibition of road building and tree falling within a 2 km radius of all homesite features in the Yeol Island in Canada in order to protect wolf pack reproduction in the area.

Table 8-45 Duration of Construction Works at sections with High Potential for Wolf Presence

<table>
<thead>
<tr>
<th>Pipeline Section</th>
<th>Average Rate of Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>NW of Loutros village (approx. KP 24 - 33) (Southern Evros Section)</td>
<td>300 m/ working day</td>
</tr>
<tr>
<td>N of Palagia village (Kirki area) (approx. KP 43 - 62) (Southern Evros Section)</td>
<td>72 m/ working day</td>
</tr>
<tr>
<td>Kavala Mountains (approx. KP 183-193)</td>
<td>72 m/ working day</td>
</tr>
<tr>
<td>Kroussia Mountains (approx. 295-325)</td>
<td>150 – 300 m/ working day</td>
</tr>
<tr>
<td>Vermio pass (Loutrochori – Pyrgi) (approx KP 431– 452)</td>
<td>72 – 350 m/ working day</td>
</tr>
<tr>
<td>Kleissoura – Korissos (approx KP 491– 501) (Askio Mountains Section)</td>
<td>72 m/ working day</td>
</tr>
<tr>
<td>Oinoi – Ieropigi Pass (Polyanemos – Greek/ Albanian border) (KP 538 – 546)</td>
<td>300 m/ working day</td>
</tr>
</tbody>
</table>

Source: ASPROFOS (2013), ERM (2013)

Table 8-45 shows the estimated rate of construction works (see section 4) through areas which are considered strongholds for the species’ distribution (see below). The construction progress in these areas ranges from 72 to 350 meters per working days, depending on the topography of each area. During these periods there could be some disturbance to the wolf population. However, the construction works, in each individual section, will be temporary in nature. The overall construction duration, including all sequential activities from site preparation up to trench backfilling in most of these areas will last up to about 1 year. However, the construction front will remain active in the same location for no more than approximately three (3) months. Table 8-45 also shows the known areas of high suitability for wolves. For the areas of Kirki, Kavala Mountains, Loutrochori– Pyrgi and Kleissoura– Korissos the construction works (of relatively long duration and in most cases within 1-2 km from sites of high suitability) are likely to pose high disturbance for breeding animals there if they take place during spring and summer.

In Southern Evros the most probable home site region (den sites, rendezvous sites) is located approximately at northwest of the Loutros village and is related to TAP segment KP 29- 32 at a distance of 330 meters from the centerline. Although TAP alignment follows the already existing DESFA pipeline route and mainly over ridges, it crosses highly suitable home site habitat from KP 30 to 31. From KP 43 – 62, the area has the same characteristics, especially the segments from KP 47-50, KP 52-57, and KP 59-61. The TAP alignment follows the existing DESFA pipeline but in these cases it avoids crossing highly suitable habitats for wolf.
In Kavala Mountains, frequent wolf reproduction was reported from local farmers and habitat evaluation confirmed the suitability of the site as wolf habitat both for foraging and reproduction. The most suitable site close to the TAP alignment is located at KP 189-191 segments in a distance from 0 to 1200 meters, with a large un-fragmented rugged ravine with dense evergreen scrubland in good condition, combined with water springs and low density of forest roads. In Kroussia Mountains the TAP alignment bisects highly suitable homesite area from approximately KP 296 to 310. The TAP construction is expected to cause fragmentation impacts on a previously un-fragmented area. Habitats of high suitability for Wolf on both Kavala and Kroussia Mountains are not fragmented.

Areas of high suitability for wolves include also the Vermio Pass at KP 431-452, the Kleisoura Pass(KP 491-501) at the Askio Mountain baseline section and a smaller area between Oinoi and Ieropigi (KP 538-546) near the Greek/ Albanian border. The working strip could potentially reduce habitat suitability.

As a result of the analysis above, the impacts of construction activities of long duration in the certain areas of high suitability for wolves (i.e. Kavala Mountains, Kroussia Mountains, Vermio Pass, the Kleisoura Pass and the Greek/ Albanian border) are considered of medium magnitude.

As mentioned in Section 6 (6.3.3.2.2), the wolf in Greece is considered Vulnerable according to the Red Data Book – Greece (with a population of only about 600 individuals), although the European Habitats Directive identifies Canis lupus as a “priority species”; and a “species of community interest in need of strict protection” for the Greek wolf populations only south of the 39th parallel (i.e. Central Greece). Thus there is no special designation for wolves in Northern Greece. Assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact should be assessed as being moderate. Residual impact, after the implementation of the mitigation measures is summarized in the Section 8.7.2.3.

Golden Jackal

Based on the field surveys, the Golden Jackal (Canis aureus) occupies regions in the eastern section of the pipeline route that are parts of its greater expansion within the Evros, Xanthi and Serres Regional Entities. Table 8-46 presents the territories of jackals within the study area and the corresponding construction durations.
Table 8-46 Duration of construction works at sections with golden jackal presence

<table>
<thead>
<tr>
<th>Pipeline KP chainage</th>
<th>Average Rate of Construction</th>
<th>Jackal territories within the study area</th>
<th>Closest distance to the pipeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>300 m/ working day</td>
<td>6</td>
<td>0 m</td>
</tr>
<tr>
<td>34-35</td>
<td>300 m/ working day</td>
<td>1</td>
<td>2 km</td>
</tr>
<tr>
<td>117-126</td>
<td>400 m/ working day</td>
<td>5</td>
<td>100 m</td>
</tr>
<tr>
<td>150-159</td>
<td>350 m/ working day</td>
<td>10</td>
<td>0 m</td>
</tr>
<tr>
<td>282-295</td>
<td>350 m/ working day</td>
<td>2</td>
<td>0 m</td>
</tr>
</tbody>
</table>

Source: ASPROFOS (2013)

The presence of vagrant individuals is expected to be possible in the wider region but these five key sections have been identified along the pipeline route. The groups detected approximately between KP 34 and KP 35 are not as susceptible of being affected by the project as the others, since their main territory lies over 4 km south of the 500 m pipeline zone and seems to be connected with the populations of the rest of the Evros delta. On the contrary, the pipeline passes through the jackal territories in the first 3 km of the alignment, close to the Greek/Turkish border and in Nestos area, where also the highest density of jackals has been recorded.

As mentioned in Section 6 (6.3.3.2.1), the jackal is not considered a priority species for the European Union and therefore it is listed on Annex V of the EU Habitats Directive. It is assessed as species of Least Concern by the IUCN and listed on the Appendix III of CITES, and is showing a global increasing population trend. On the contrary, in Greece a recent view of the species status in the Red Data Book for Greek Vertebrates declares it as “Endangered” that is a taxon considered to be facing a very high risk of extinction in the wild due to the decline of its population and the fragmentation of its habitat. As a result, the sensitivity of this species is major.

The jackal is known to be adaptable species, whenever the disturbance is temporary and short term and it does not change habitat quality and food availability. When the disturbance is long term, the species would be expected to migrate from the area. Based on Table 8-46, the largest duration of construction activities performed on one particular area (KP 282-296) is approximately 40 days of constant presence in the area, although intermittent activities including backfilling may last up to one (1) year. The preservation and restoration of safe and high productivity habitat is first priority for jackal conservation.
Assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact should be assessed as being moderate. Residual impact, after the implementation of the mitigation measures is summarized in the **Section 8.7.2.3**

### 8.7.2.1.3 Species / Population Loss

*Spermophilus citellus* colonies are prone to local extinction in cases where the colonies are found within the working strip or in its immediate vicinity. These small mammals are especially vulnerable during hibernation (September – late April) and after parturition (June). In particular, project activities may result in:

- Direct mortality of the ground squirrel individuals or as a result of the destruction of their burrows.
- Increase of road traffic accidents and direct mortality of the ground squirrel from the passing construction vehicles.
- Change to animal habitat resulting from right-of-way clearing and other construction activities applied directly to areas where habitat will be lost, and indirectly to adjacent areas. The degree to which the species will be affected is site specific and depends on the amount and type of habitat lost as well as on the size, mobility and home range of the animals.
- Change to ground squirrel movement patterns. Although it is suspected that the species will alter its behaviour to avoid construction areas, it may also be attracted in these areas, for example, by garbage. The most substantial changes in movement patterns are anticipated to occur in areas where the pipeline is constructed along a route that is not parallel to existing linear developments (e.g. pipelines, roads etc.). In these areas, travel corridors, feeding sites and nesting sites could be bisected or lost and individuals may alter their behaviour accordingly.
- Change to ground squirrel behaviour as a result of sensory disturbance. Sensory disturbances include aural disturbances, such as blasting and equipment operation, olfactory, for example machine odour, and/or visual, such as the occurrence of construction personnel and equipment. Potential responses to these disturbances include undetectable metabolic changes (e.g. accelerated heart rate), to movement away from the disturbance.
The colonies observed within the working strip or its immediate vicinity, during the field surveys, are listed in Table 8-47.

### Table 8-47  
**Spermophilus citellus Colonies (verified or very likely) within the Working Strip or Immediate Vicinity**

<table>
<thead>
<tr>
<th>Geographical area</th>
<th>Approx. KP chainage</th>
<th>Habitat</th>
<th>General comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near Kipoi</td>
<td>0-4</td>
<td>Clover field</td>
<td>A colony detected at KP 3.4 that according to local people may extend between KP 0 and 4</td>
</tr>
<tr>
<td>Near Kavisos</td>
<td>17.3</td>
<td>Fallow field</td>
<td>One potential colony observed</td>
</tr>
<tr>
<td>Between Lofario and Aetolofos</td>
<td>73-76</td>
<td>Meadows with <em>Paliurus</em> spp</td>
<td>Holes detected in KP 73.8 and considered to be part of one colony, extended between KP 73 to KP 76.</td>
</tr>
<tr>
<td>Drymos Village</td>
<td>341-343</td>
<td>Fallow field, Meadow field, Cultivated field</td>
<td>Two systems of burrows both within the 500m corridor. However only two of the burrows seemed to be active. Potential remnants of a largest colony.</td>
</tr>
<tr>
<td>Nea Messimvria to Gefyra villages</td>
<td>361-369</td>
<td>Agricultural land</td>
<td>A minimum of five (5) colony reports(^1) were detected within this area</td>
</tr>
<tr>
<td>Maniakio to Galateia villages</td>
<td>453.8-482</td>
<td>Agricultural land</td>
<td>This area hosts up to 13 colonies</td>
</tr>
</tbody>
</table>

**Source:** *Spermophilus citellus* field survey (July 2011, May 2012 and October 2012, April and May 2013)

From the above Table 8-47 it can be seen that project construction activities may cause a loss of some of the ground squirrel colonies in the wider area, therefore the magnitude of the impact is medium. Currently, it is not possible to assess to what extent the impact would affect a significant number of colonies. Nevertheless, given that the European Habitats Directive identifies *Spermophilus citellus* as a species of community interest (Annex II species); and a "species of community interest in need of strict protection" (Annexes IV), the sensitivity of the species is considered high. Assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact should be assessed as being *moderate*. Residual impact, after the implementation of the mitigation measures is summarized in the Section 8.7.2.3.

Direct mortality of *Reptile and Amphibian* populations is also expected to occur during excavations and clearing of vegetation. Increased vehicular traffic is also expected to cause a rise in losses of tortoises and snakes due to collisions. 27 species, ten species of amphibians, that is 84% of expected species, and seventeen reptile species, that is 59% of expected species,

\(^1\)colony reports: species homesite detection which may refer to the same or different colonies
were observed along the route. All these could be impacted due to direct mortality. All of these are dispersed in a larger scale over the project area; therefore the magnitude of the species likely to be affected is low.

Snakes are often persecuted, but usually not to an extent that will cause a conservation problem. Tortoises do not exhibit territorial behaviour but still show fidelity to their hibernation sites (Stubs et al. 1985). It is possible that tortoise mortality will increase during 1-2 years following the construction phase due to increased visibility of young and vulnerable individuals to predators (Hailey, 2000; Sanz-Aguilar, 2011). In the case of this project though, the clearing of vegetation will be followed by increased human disturbance that will probably discourage the animals from immediately using the new open sites. The width of the pipeline route will not be large enough to increase predation risk. The openings that will be created during the pre-construction and construction phases are expected to increase diversity in the context of a landscape with a fine-grained mosaic structure. This will result in increasing available habitats for reptiles and will offer more thermoregulatory points, provided that the area will be left to be subsequently covered with natural vegetation of indigenous and local species. It is well established that the procedure of “opening” forest areas or grasslands has a positive impact on the majority of reptilian species (Cano and Leynaud, 2010). In the mid-term the pipeline construction procedures may favour some reptile populations.

The habitat requirements of amphibians vary seasonally; therefore the distribution of resources across the landscape relative to the project can influence mortality. These resources are associated with refuge, mates, and prey that tend to be concentrated in distinct habitats that have a patchy distribution. A common characteristic of these habitats is the proximity to water bodies. Although few rivers are crossed by the pipeline, the crossings are located in a very specific area of the water body. In case the crossings are overlapping with the areas hosting the resources previously described, some loss of individuals could be incurred.

On the basis of the discussion above and assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact on reptiles and amphibians needs to be assessed based on the following information:

---

1 In multisuccessional habitats spur-thighed tortoises selected habitat with low vegetation cover values and found in early stages of vegetation succession over more complex mixed shrubland. Additionally, small-scale non-irrigated croplands seem to increase the habitat quality for both tortoise species (Anadón et al. 2006).

amphibians should be assessed as being minor. Residual impact, after the implementation of the mitigation measures is summarized in the Section 8.7.2.3.

The immediate impact during construction on populations of rare/protected/endemic flora taxa has been calculated according to the field sampling results (spring 2011, autumn 2012, spring 2013) within the pipeline route and is presented in Table 8-48. This table presents the total number of individual plant (mostly annual species) potentially affected by the clearance of the working strip along the 543 km of the pipeline route. Data is presented by habitats as the abundance of taxa of conservation interest varies between the different habitats and therefore the number of individuals potentially affected.

### Table 8-48

<table>
<thead>
<tr>
<th>Main vegetation types sampled for assessment of protected/endemic/rare flora species</th>
<th>Average abundance (number of individuals) of protected/rare/endemic flora species impacted along pipeline route&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>during construction of regular working strip (38m)</td>
</tr>
<tr>
<td></td>
<td>upper 95% c.l.</td>
</tr>
<tr>
<td>Fagus forests&lt;sup&gt;3&lt;/sup&gt;</td>
<td>15,238</td>
</tr>
<tr>
<td>Deciduous Oak (Quercus) forests&lt;sup&gt;4&lt;/sup&gt;</td>
<td>59,624</td>
</tr>
<tr>
<td>Meadows/shrublands&lt;sup&gt;5&lt;/sup&gt;</td>
<td>387,680</td>
</tr>
<tr>
<td>Pinus forests&lt;sup&gt;6&lt;/sup&gt;</td>
<td>31,297</td>
</tr>
</tbody>
</table>

Source: ERM (2012), APROFOS (2013)

In summary, Table 8-48 indicates that during construction along a regular working strip within Fagus forest the population impacted is on average expected to be approximately 15,000 (fifteen

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<sup>1</sup> The broad range of values is due to the large heterogeneity within vegetation types.

<sup>2</sup> c.l.: confidence level

<sup>3</sup> Refers to habitat type 9130. Taxa: Centaurea napulifera susp. napulifera, Anacamptis pyramidalis, Neottia nidus – avis, Platanthera chlorantha, Cephalanthera rubra, Epipactis sp

<sup>4</sup> Refers to habitat type 9350, 9250, 925A, 924A. Taxa: Centaurea napulifera susp. napulifera, Anacamptis pyramidalis, Neottia nidus – avis, Platanthera chlorantha, Stachys plumosa, Stachys iva, Anthyllis vulneraria subsp. adnetricha, Paonia peregrine, Cephalanthera longifolia, Orchidaceae, Ruscus aculeatus, Verbacem phoeniceum sp. Flavium, Cistus ladanifer

<sup>5</sup> Refers to habitat types 6210, 6420, 6290, 62A0, 6450, 5210,5160, 5340, 5350. Taxa: Centaurea napulifera susp. napulifera, Anacamptis pyramidalis, Anacamptis morio, Anthyllis vulneraria subsp. bulgarica, Anacamptis papilionacea, Silene subintegra, Platanthera chlorantha, Cephalanthera longifolia, Epipactis sp, Phlomis samia, Ophrys scolopax subsp. cornuta, Ophrys mammmosa

<sup>6</sup> Refers to habitat type 9540. Taxa: Ruscus aculeatus, Malus trilobatus, Onosma halacsiy
thousand) plant individuals. For Quercus forests this number becomes approximately 60,000 (sixty thousand) plant individuals. For Pinus forests this number becomes approximately 31,000 (thirty one thousand) and for meadows/ shrublands it becomes approximately 388,000 (three hundred and eighty eight thousand) individuals. As presented in Table 8-44, other natural habitat types (i.e. except for cultivated lands and urbanized areas) occupy, in total, less than 1 % of the regular 38 m working strip and have not been included in the assessment of species lost. It is repeated that the number of species refer mostly to annual species, grassland and herb species.

These average abundance figures are considered to be the minimum flora individuals affected during Project construction for the following reasons:

- It does not include the impact on trees.
- It refers only to the rare/protected/endemic taxa discussed in Table 8-48.
- It was not possible to survey the entire area potentially affected by the Project due to restricted access, especially in the vicinity of the Greek/ Albanian border. The remaining land is considered very likely to contain rare/protected/endemic taxa as well.
- It does not refer to extremely rare flora species, stenoendemics or species that were outside their flowering season, so impossible to identify in spring/summer.
- It does not refer to common species, not taken into account during the field surveys.

As far as spring flowering taxa are involved: the number of impacted plant individuals is reduced by 53% when a minimum working strip (18 m) is adopted instead of a regular one (38 m). In case of a reduced working strip of 28 m, the impacted flora population will be 73% of what is expected to be impacted compared with the use of a 38 m working strip.

The expected mortality on flora species populations during the working strip preparation may be seen as high but it is not unexpected given that most of these taxa are generally well-represented in the study area despite their endemicity or protection status. Moreover, this construction-imposed mortality is very likely to replace to a certain extent, natural mortality which will occur anyway due to climatic factors, grazing, fungi and microbiological infections, trampling by humans and/or animals. Because there are no data on the population dynamics of any of these species in Greece, it is unknown to what degree the construction-induced mortality will replace mortality by natural factors.
With regard to impact significance, although the discussed species are endemic, they are rather widespread and therefore species sensitivity is considered medium while the magnitude of the impact is small given the natural mortality and the fraction of the species affected. Assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact on rare/protected/endemic flora taxa should be assessed as being **minor**. Residual impact, after the implementation of the mitigation measures is summarized in the Section 8.7.2.3.

### 8.7.2.1.4 Disturbance and Displacement of Fauna – General Construction Activities

The **Brown Bear (Ursus arctos)** is one of the species most likely to be disturbed, and therefore displaced during the construction activities at certain sections along the route. Brown bears do remain dependent on specific habitat characteristics that have to be present at least in the core area of their habitat range and which subsequently play a key role on the species’ main biological functions and ecological requirements. Such characteristics are related to habitat quality, availability and accessibility in terms of adequate food resources, security/refuge and other specific ecological requirements which relate to the species yearly reproductive cycle such as lack of disturbance in suitable seasonal habitat for denning (winter habitat) and litter rearing (spring habitat).

It has been observed that the distance at which bears are potentially disturbed by tourist resorts and villages (which have the same effect) is likely to be dependent upon age and sex and possibly the previous experience of the individual bear with human presence (Nellemann et al. 2007 quoted by Swenson): areas within 10 km from resorts and settlements have a relatively higher proportion of sub-adults whereas 92% of the old males and 74% of all females are usually found beyond 10 km from resorts and settlements (Schwartz and Franzmann, 1992; Muller et al., 2004 in Nellemann quoted by Swenson).

Bears are sometimes attracted to roads because grasses and clover are sometimes seeded on right-of-ways. Occasionally, bears can be displaced from habitat near roads: grizzly bears are known to avoid open roads in general, yet in protected populations some bears become habituated to the point that they will use roadside verges with apparent disregard for human traffic on it (McLellan et al. 1985, McLellan and Shackleton 1989, Tracy 1977 in Jalkotzyet al.)
1997 quoted by Gibeau). Bears avoid some categories of roads during the summer season and for denning (Yri 2006, Elfström et al. in press quoted by Swenson). If traffic volume decreases at night, then bears will make use of adjacent habitat. The greatest impact of the roads is however the enhanced accessibility of previously isolated areas to be humans.

Data on the impact of construction noise was examined for the first time in Greece within the case study of Egnatia highway (“Grevena-Panagia” stretch) (2005-2008). In this case data from noise levels (during day and night hours) from working camps along the highway and bear telemetry data were combined in order to find an eventual interaction. Mapping of acoustic isolines and correlation of noise levels and bear telemetry data during night hours showed the following correspondence between telemetry bear location frequencies (%) and noise levels:

- 78.95% = 25- 47 dB(A)
- 16.52% = 47- 53 dB(A)
- 2.66% = 53- 59 dB(A)
- 1.05% = 59- 65 dB(A)
- 0.81% = 65- 76 dB(A)

Mapping of acoustic isolines and correlation of noise levels and bear telemetry data during daylight hours (from 0630 to 1730 hrs) showed that 46.98% of bear activity locations corresponded to noise levels of 44-57 dB(A) and also that the lowest bear activity levels (0.08% of locations) corresponded to noise levels of 76-89 dB(A). Intermediate correlations between bear activity and noise levels gave: 44.32% of activity locations within 44-57 dB(A) of noise levels, 6.04% within 57-63 dB(A) and 2.58% within 63-76 dB(A) of noise levels. These results indicate a gradual decrease of bear activity as noise level increases.

The brown bear (*Ursus arctos*) impact assessment during construction of the pipeline revealed the following areas as of major concern: the Vermio Pass, the Kleisoura Pass, and Aliakmonas River crossing and the Greek/Albanian border. Digging works during the pipeline construction phase although of linear disposition might have an impact upon the existence of bears denning sites in the areas of highest habitat suitability. Given the fact that bears exhibit a systematic avoidance of sectors close to forest roads or to disturbances from human activity areas, it is expected that dens and denning sites may be abandoned in the vicinity of the pipeline.
construction works. The noise pressure data indicate that bears are most likely to move to a minimum of 500 m away from the construction zone.

On the basis of the above discussion, the magnitude of the impact to the bear population from Project construction activities in the areas of Vermio pass, Kleisoura Pass, Aliakmonas River crossing and the Greek/Albanian border is considered moderate, as a notable part of the population is affected to the degree that the habitat may be abandoned altogether. The species is protected under Greek legislation and is an “endangered” species according to the Red Data Book – Greece while it is identified as a “priority species” and a “species of community interest in need of strict protection” by the Habitats Directive (Annexes II and IV) consequently, the sensitivity of the species is high.

Assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact should be assessed as being major. Residual impact, after the implementation of the mitigation measures is summarized in the Section 8.7.2.3.

With regards to the jackal, it has been shown in this study that the pipeline passes through three jackal territories. It is remarkable that, from KP 0-3 where a territory has been indicated, although intensive construction works of the Greek army seem to have been well tolerated by the species, it is likely however that continuous and permanent disturbance can lead to the abandonment of the region. This has probably already happened near Kipoi village (where the customs are located) where no jackal group was recorded during this study. Additionally from KP 149 - 164 and 115-126 at least 8 jackal groups were detected around Nestos river and another 6 groups north and North-east of Vistonida lake respectively. Both regions host, according to literature, the biggest jackal population of the country and it is considered that there is a serious risk of disturbance and degradation of very important habitats. Especially the pipeline route between KP 154 - 159 that is aligned parallel and very close to Nestos river can cause severe degradation of the habitat during the construction phase, which may permanently limit the suitability of the area for jackals. In the area of Vistonida lake the construction phase will probably cause temporary disturbance on breeding jackal groups during spring and summer months. From KP 281 - 296 where two jackal groups were detected the area is considered as a very suitable habitat for jackal groups and a corridor that potentially can facilitate the linkage between the groups of Kerkini lake in the north and Strymonas Delta in the south (Amphipoli village). The construction phase will cause temporary disturbance on breeding jackal groups during spring and summer months.
Construction of secondary works (access roads, artificial lighting, other installations) may permanently limit suitability of the area for jackal habitat.

Overall, jackals are expected to be relatively adaptable to temporary disturbances generated by construction activities (e.g. presence of humans, earthworks and heavy machinery), nevertheless wherever these alterations are permanent (or extend over long periods of time) or lead to relevant changes in the resources availability it is expected that Jackals would be displaced. Specifically, the most stationary phase of the jackal pack annual cycle (that is the breeding period) may therefore be strongly affected from TAP construction works if they take place during spring and summer. The working strip is expected to reduce habitat suitability, thus there is a great possibility that the jackals will abandon their sites, moving northern or southern along the Evros and Nestos Rivers. Although the species is characterized by its good ability for adaptation after great habitat alterations, this only happens as soon as habitat conditions become improved.

As described in 8.7.2.1.2 assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact should be assessed as being MODERATE. Residual impact, after the implementation of the mitigation measures is summarized in the Section 8.7.2.3.

Breeding Birds are also very likely to be disturbed locally during the construction activities of the pipeline. The machinery used for the construction site might be the most significant source of potential noise disturbance, as well as generators, assembling of machinery, traffic, general construction noise, human vocalizations etc. Additional impacts may occur through the artificial light by causing deterioration of foraging habitats for nocturnal birds of prey and disorientation in nocturnal migrants. However, the use of lights during the night, if any are used, will be limited. During the construction phase, clearance of the working strip and heavy machinery operation could result in loss of nests, eggs and individuals (mainly juveniles) for ground nesting species in open areas and agricultural land during the breeding period.

The main potential impact on birds due to construction activities during the breeding period is a potential breeding failure. This can be expressed through hatching failure, due to scaring of the parents or failure of proper fledging and training of nestlings. In some cases abandonment of the territory could also be caused.
However, for many of the species found breeding in the vicinity of the pipeline route (i.e. the roller, observed breeding less than 200 m away from the pipeline route) the effect by the project activities is considered unlikely, provided that those activities will not cross their nesting site, which was the expected condition observed in the field in most of the cases.

Species that could potentially be affected by pipeline construction activities during the breeding season include both ground and tree nesting species in the area such as black stork (*Ciconia nigra*), Montagu’s Harrier (*Circus pygargus*), Levant Sparrowhawk (*Accipiter brevipes*), Lesser Kestrel (*Falco naumanni*), masked shrike (*Lanius nubicus*) and the roller *Coracias garrulus*, which were all recorded during field surveys. Additional raptors that could be impacted by the project include the Lesser spotted Eagle (*Aquila pomarina*), Short toed Eagle (*Circaetus gallicus*), Long legged Buzzard (*Buteo rufinus*) and Booted Eagle (*Aquila pennata*) which were recorded in certain areas along the pipeline. However, these species could indeed nest several kilometres away from the proposed working strip. Other species of conservational concern, like the Grey Partridge (*Perdix perdix*) and White tailed Eagle (*Haliaetus albicilla*) were observed in a wider area away from the immediate study area and are not expected to be affected by the project activities.

The most important areas identified for bird breeding include the pine forest of Loutros in the Evros prefecture where more than 10 raptorial species have been reported (five recorded in the current study) as breeders, all riparian forest along the pipeline route and the Wildlife Refuge of “Petroto -Faraggi – Almyra” where high breeding densities of Calandra Lark (*Melanocorypha calandra*) were observed.

In the area of the compressor station CS01, a hobby (*Falco subbuteo*) is known to breed on the stands of poplars widely grown along the Serres plain. As this species presents no nest fidelity it is not expected to be affected by the construction activities as the wide distribution of poplar trees in the area ensures the availability of proper nesting sites that are not disturbed by project activities as long as the nest is not located in the area directly affected by the construction activities.

Montagu’s Harrier (*Circus pygargus*) is classified as Critically Endangered in the Red Data Book of Greece (Legakis & Maragou 2009). In Greece it is known to breed only in a few areas of western and central Macedonia, with a national population of 20 - 30 pairs; at least one (1) pair is
reported to breed in the vicinity of the pipeline route, approximately 20 - 70 m from the proposed working strip, and a second pair possibly also breeds in the same area. This species nests on the ground and is expected to be affected by disturbance during TAP construction works, if the works take place during the nesting period. This species does not use the same nest for more than one year, but it normally returns to the same territory every year and the nests are probably located at distances of not more than several hundred metres from each other although longer distances of up to 10 km have been reported in other sites in Europe.

Birds flying over the project area in search of food are considered as not being disturbed by the project construction. There is a substantial availability of feeding grounds, consequently birds species are expected to adapt accordingly during the construction activities.

The magnitude of the impact of Project construction activities on breeding birds varies. Within Loutros forest the impacts are likely to be large if construction works occur there during the breeding season; for the rest of the area, the magnitude of the impact of the project is expected to be minor given that only a fraction of the protected species of avifauna habitat will be affected. Consequently, taking into consideration that most of the pipeline does not affect avifauna sites, the magnitude of impacts to avifauna is deemed minor. The sensitivity of the receptor depends on the various species. Most of the species identified as being affected by the project are common but few are of conservational interest. For birds identified as breeding in the vicinity of the pipeline route, the magnitude of the impacts is large. Consequently the overall sensitivity of the avifauna is considered to be moderate. Assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact should be assessed as being Moderate. Residual impact, after the implementation of the mitigation measures is summarized in the Section 8.7.2.3.

8.7.2.1.5 Disturbance and Displacement of Fauna - Blasting and Hammering Activities

Trenching activities in areas of hard substrate are likely to require the use of hammering and blasting. These techniques will generate additional noise emissions in comparison to normal trenching activities.
The areas where blasting and hammering are expected to take place and would potentially have an impact on species of conservational interest lie mostly on the Southern part and the lowlands of Evros (KP 27 – 31, ca. KP 49 – KP 64), on Kavala Mountains (KP 177 - 179, KP 181 - 193), on Serres Plain (KP 227 – 230), on Kroussia Mountains (KP 302 - 328), on Vermio Mt. (KP 426 - 438, 447.5 – 448.5 and KP 451.5 - 455.5), Askion Mt (KP 486 – 488 and 491 - 495) and in proximity to the Albanian border area (KP 536.5 - 542) (see also relevant table in Section 8.3 on Noise). The Loutros area (KP 27 - 31) and Kirki area (KP 43 - 62) have been assessed to be of major importance for wolf (*Canis lupus*) and breeding/wintering birds of conservational interest. Kavala mountains (KP 183-193) have been assessed as being of significance due to the frequent wolf (*Canis lupus*) species reproduction in the area and the suitability of the site as wolf habitat for both foraging and reproduction. The Kroussia mountains (KP 296 - 310) have also been assessed as being of major importance for the wolf (*Canis lupus*) due to the species permanent presence there. The Vermio Mt. (KP 425 - 443 and 445 - 446), Askion Mt (KP 490 - 496) and areas in proximity to the Albanian border area (KP 533 - 543) have been assessed to be of major importance for protected species such as wolf (*Canis lupus*) and brown bear (*Ursus arctos*). Regarding the jackal, the species is not expected to be affected by blasting and hammering activities, since no population was recorded in the areas where blasting and hammering are expected to be required.

As reflected in Section 8.7.2.1.3, several studies have shown that brown bears tend to avoid areas with elevated noise levels, having a clear preference for those areas where sound pressure is below 47 dB(A) (Giannakopoulos *et al.* 2010). Wolves are also known to avoid areas of human activity.

Indicative noise pressure levels generated by these construction activities, considering an unattenuated level at source of 115 dB (A), are presented in Table 8-49.

| Total noise pressure level [dB(A)] at distance from working strip |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                          | 50 m                    | 100 m                   | 250 m                    | 500 m                    | 1,000 m                  |
| **Blasting and Hammering** | 70                      | 64                      | 56                       | 50                       | 44                       |

*Source: ERM (2012)*

Based on these noise pressure levels, the potential impact from noise on the aforementioned species might be up to 1 km either side of the working strip whilst blasting and hammering is undertaken along the identified sections. The total area potentially affected along these sections...
will be up to 17,900 ha. Assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact should be assessed as being moderate to major when conducted during the breeding season and bear hibernation period.

However, blasting and hammering are temporary, generally discrete activities and although having the potential to disturb bears and wolves, such individuals will naturally try to avoid areas of human activity. Thus, if planned outside of the breeding season (April to August), when these species are highly sensitive and likely to abandon dens and denning sites if disturbed, impacts are considered to be not significant. Similarly, with regard to periods of bear hibernation, if works start in early autumn, individuals are unlikely to use any suitable over-wintering dens that are within proximity to the pipeline working strip through the Vermio region. It is presumed that any affected areas will be reused by the species after the works have been completed.

An additional blasting section, between KP 452 and 456 is likely to affect a *Spermophilus citellus* colony leading to either abandonment of the colony or even direct mortality as a result of destruction of their burrows. In this case and assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact should be assessed as being major.

8.7.2.2 Mitigation Measures

8.7.2.2.1 Habitat Loss

General measures to minimise habitat loss during construction will include:

- Establishment of a working strip to restrict area of impact to within the working corridor;
- Implementation of a reduced working strip (28 m) through sensitive habitats (European or Greek habitats), as required;
- Implementation of a minimum working strip (18 m) through Priority European habitats;
- Pre-construction habitat surveys must be conducted so as to identify specific issues (e.g. potential overlap with a priority habitat type e.g. 3170);
- Access road upgrading will follow existing tracks and trails where possible;
- Construction facilities to be sited on unused land of no particular ecological value;
- No construction materials will be taken from the surrounding environment unless approved by the competent authority;
- Restoration of sites to their baseline condition where possible upon completion of construction (retaining as much of the original vegetation as possible for reinstatement);
- Establish a pre- and post- construction biodiversity baseline from which all mitigation, restoration, and loss / degradation can be measured;
- Work to retain passage for species as long as possible across the corridor, and then following the works the reinstatement of passages should be conducted immediately upon pipe section completion;
- Translocate important flora species to other suitable areas; if necessary or appropriate this is to be assessed on a case by case basis – no specific species or sites have been identified during the baseline surveys;
- Habitat compensation measures should be considered where required to replace permanently lost and damaged habitats. This may include new habitat creation, restoration of damaged habitats and habitat enhancement. Habitat compensation measures will be determined in cooperation with all stakeholders;
- Work to be supervised by an on-site Ecological Clerk of Works (ECoW);
- Ecological awareness training should be provided to all personnel;
- Establish a Forest Fire Risk Prevention Plan;
- Establish a Reinstatement Study prior any construction work beginning. The reinstatement study will be approved by the competent authority;
- In selected, major, river crossings, trenchless techniques (such as HDD) will be investigated in order to minimize impact on riparian vegetation;
- In forested areas, the construction working strip will be reinstated in cooperation with the competent authorities. If requested, the strip will be formatted in such a way as to server as a fire protection belt.
8.7.2.2.2 Habitat Fragmentation

The following mitigation measures will be implemented to the extent that is possible:

- KP 115 to 123.7 no temporary or permanent facilities should be constructed in this area. The passage of heavy machinery and traffic should be restricted to existing roads to the extent that is possible and the use of the existing road networks must be preferred. Vehicles should move with a low speed within the sites;

- KP 186-193: no temporary or permanent facilities should be constructed in this area. The passage of heavy machinery and traffic should be restricted in main forest roads to the extent that is possible. Blasting and road openings/ upgrades, creation of any new infrastructure and dawn/dusk day activities should be reduced to the minimum extent possible;

- KP 296-310: no temporary or permanent facilities should be constructed in this area. The passage of heavy machinery and traffic should be restricted to main forest roads to the extent that is possible. Blasting and road openings/ upgrades should be reduced to the minimum extent possible;

- KP 430 – 432.5: No secondary works / roads should be undertaken/ constructed inside these stream valleys and southwards. No temporary facilities should be constructed. The passage of heavy machinery and traffic should be restricted to main forest roads, as much as possible. Avoid blasting, where possible. Avoid dawn/dusk day periods;

- KP 434.6 – 436.7: Avoid where possible constructing new roads, and use the existing network;

- KP 437.5: Avoid where possible constructing new roads, and use the existing network inside these stream valleys. No temporary facilities should be constructed. The passage of heavy machinery and traffic should be restricted to main forest roads to the extent that is possible;

- KP 439.5: Avoid where possible constructing new roads, and use the existing network inside these stream valleys. No temporary facilities should be constructed. The passage of heavy machinery and traffic should be restricted to main forest roads to the extent that is possible;

- KP 439.5-445.6: Avoid where possible constructing new roads, and use the existing network;

- KP 491.3-492.3: Avoid where possible constructing new roads, and use the existing network;
- KP 495-496: Avoid where possible constructing new roads, and use the existing network. No temporary facilities should be constructed in this area;
- KP 538.3: No temporary facilities should be constructed in this area;
- KP 538.8: No secondary works / new roads should be undertaken/constructed inside the surrounding valleys. No temporary facilities should be constructed in the vicinity of these ravines (earthworks, artificial lighting, camps, heavy machinery camp);
- KP 541.4: Avoid destroying stands of mature trees.

In all identified sensitive areas as indicated above, avoid construction activities between mid-March to end of July and at dawn or dusk to the extent that is possible.

8.7.2.2.3 Disturbance and Displacement

The following mitigation measures apply to potential impacts causing disturbance and displacement of fauna, to those related to general construction activities (Section 8.7.2.1.4) as well as to those related to blasting and hammering activities (Section 8.7.2.1.5). The management of impacts to species of conservation interest, as the bears, wolves, jackals, and ground squirrel will be detailed in a Biodiversity Action Plan which will be part of the ESMMP.

Wolf (Canis lupus)
Along the areas identified as of high suitability for wolves (KP 29 – 31.2 (Loutros forest), 47 - 50, 52 - 57, 59 - 61, 189 - 191, 296 - 310, 428 - 432 and 439 - 441) the following mitigation measures should be applied to the extent that is possible:

- Construction activities close to wolf areas of high suitability should be avoided from mid-March (preparation of the den site by pregnant females) till end of July (increased mobility of wolf pups);
- Heavy machinery and traffic will be limited to using the main forest roads and the already existing DESFA pipeline ROW to the extent that is possible;
- Avoid dawn-dusk and night-time works, when wolves and activity around dens is increased;
- The pipeline installation should follow and be as close as possible or within the existing DESFA ROW strip width where applicable;
Avoid blasting activities to the extent that is possible;

No auxiliary facilities should be constructed or artificial lighting installed;

Avoid destruction of stream riparian vegetation by the adoption of a reduced working strip to the extent that is possible; and

A Biodiversity Action Plan (BAP) will be implemented as part of the ESMMP.

**Jackal (Canis aureus)**

In areas identified of high suitability for jackal’s habitat (see Table 8-46), the following mitigation measures should apply:

- Construction works should not be carried out during those periods that are critical for the species as appropriate, i.e. avoid construction works between March and July, to avoid disturbance during breeding season and birth period;
- The status of territories along the working strip and in its vicinity just prior to construction should be recorded, as it will be detailed in the Biodiversity Action Plan;
- No temporary facilities should be constructed;
- No passage of heavy machinery traffic should be allowed except on main existing roads;
- Vehicles should move with a low speed within the area;
- Where possible avoid blasting activity;
- Where possible avoid dawn/dusk periods of the day;
- Where possible avoid destroying riparian and shrub vegetation to increase the possibility of jackals’ resettling in the area; and
- A Biodiversity Action Plan (BAP) will be implemented as part of the ESMMP.

**Bear (Ursus arctos)**

Where possible, the adoption of construction time restrictions, specifically from April to early August, on those areas identified as of interest for bears and wolves, will greatly reduce the disturbance on these species from blasting and hammering activities. Additional measures specific for bear are presented below for the main sections of concern:
- In section Ano Grammatiko to Kato Grammatiko (KP 439.5 – 445.6) then cross forested areas with the reduced working strip to eliminate destruction of bear habitats which are used regularly;
- In Kleisoura area (KP 490 - 497) cross forested areas with the minimum possible working strip to eliminate destruction of bear habitats which are used regularly;
- KP 527 – 529: cross Aliakmonas River with the minimum possible working strip to eliminate destruction of bear habitats of regular use; and
- KP 539 – 543: cross forests with the minimum possible working strip to eliminate destruction of regularly used bear habitat;
- A Biodiversity Action Plan (BAP) will be implemented as part of the ESMMP.

**European ground squirrel (Spermophilus citellus)**

A pre-construction survey will be carried out to identify any *Spermophilus citellus* colonies and potential colony sites, especially in the vicinity of current identified colonies. If colonies are present within the working strip then the temporary displacement procedures presented in Hertweck (2012)\(^1\) should be adopted prior to construction, together with the following considerations:

- Capture, handling and transport of the animals must be in accordance with the Animal Protection Act;
- Supplementary feeding of the animals is required;
- Composition of vegetation cover (forage plants) as well as height of vegetation 15-30 cm shall be suitable for the animals;
- The new habitat and ground-squirrel-friendly management shall be secured on a long-term basis (5 years until the end of the monitoring);
- Connectivity with other colonies must be ensured – the location and size of neighboring colonies must be known;
- Small groups of animals (less than 180 individual animals and/or 30 adults) should be added to an existing colony. Care has to be taken that the habitat provides sufficient resources for all animals;

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Protection against predators. If there are signs of an increased appearance of predators, special protection measures have to be taken (e.g. fencing in of partial areas, placement of nets against birds of prey);

Monitoring of diseases and/or parasite infestation; and

A Biodiversity Action Plan (BAP) will be implemented as part of the ESMMP.

Montagu's harrier \((\textit{Circus pygargus})\)

The Montagu's harrier is a summer visitor to Greece, present in the breeding territory only from April to August. Therefore avoiding construction in suitable breeding territory through this period will avoid any impacts to this species. An additional field survey should be conducted along KP 529 to 534 if summer works are required along this section or if works are delayed (but only if a nest is located within 200 m of the working strip).\(^1\)

Other Breeding birds

- Where possible undertake vegetation clearing (of trees, bushes etc.) of pipeline working strip and construction sites before or after the breeding season, i.e. before March 1st or after September 30th;

- On pipeline route sections with potentially important breeding bird habitats, discourage birds to breed by installing plastic bands (e.g. warning tape) that flutter in the wind, before the breeding season starts i.e. before March 1\(^{st}\)(birds are then likely to avoid breeding on and along the construction strip, and when pipeline construction starts then the presence of breeding birds will be minimised);

- If it is a necessity to clear vegetation within the period 1\(^{st}\) March- 31\(^{st}\) July (bird breeding season) pre-vegetation clearance surveys will be undertaken by qualified ornithologists focusing on mature trees and riparian vegetation. If nests of species of conservational interest should be located within the vicinity of the working strip, no works will be carried out within at least a 25 m buffer of the nest site until chicks have fledged from the nest or it is naturally abandoned. Otherwise, relocation of the nest, depending on the importance of the bird species, could be investigated;

- The adoption of a Construction restriction period between March and July will be considered for the following sections:
  - KP 29 – 32 (Loutros forest) and KP 47-62, due to the presence of up to 10 breeding raptors among other species:

\(^1\)Nest site fidelity is relatively high although it can vary from a few hundreds meters to a few kilometers.
KP 227 – 230 due to the high breeding densities of Calandra Lark (Melanocorypha calandra) observed.

KP 236.4 – 238.5 due to the potential breeding activity of black stork (Ciconia nigra) along the streams crossed.

KP 268 (site of CS01) due to the nesting of Falco subbuteo in stands of planted poplar along the area, but only if nesting in the area affected by the construction of the compressor station has not been prevented previously.

KP 290 – 290.6 due to the potential breeding territory of the Lesser spotted eagle (Aquila pomarina).

KP 350.5 – 355.5 due to the presence of various migratory bird species on spring and the presence of a breeding pair of Long legged Buzzard.

KP 323.5 – 327.5 due to the presence of a breeding pair of Lesser spotted eagle.

The adoption of an additional construction restriction period between October and end of March may be considered for the section from KP 29 to 32 (Loutros forest) and reed beds at KP 159.7 due to the presence of the wintering specie of the spotted eagle and the moustached warbler respectively. Such restrictions should be validated by a special ornithological study for these two species prior to construction.

8.7.2.2.4 Species / Population Loss

Impact on protected/rare/endemic flora species

It is unlikely that any particular mitigation measures will be a necessity regarding the recovery of rare/protected/endemic plant taxa along the working strip.

The flora taxa of conservation interest found along the pipeline route mainly belongs to the families Orchidiaceae (orchids), Labiatae and Caryophyllaceae. The pollination of most European orchids is mediated by insects (Hymenoptera, Diptera, or Lepidoptera), but asexual seed formation and autogamy are also common (Neiland & Wilcock, 1995). Seeds are produced in large numbers and can locally achieve a fairly dense coverage around the mother plant (Rasmussen, 2008). They are effectively dispersed by the wind and are able to travel distances of several kilometres, while even significant long distance dispersal events of up to 450 km have frequently been recorded (Rasmussen, 2008; Molnár et al., 2011).
Many of the orchids found along the route as well as many of the other flora taxa of conservational interest were recorded at numerous locations and often in high densities, and except for the Balkan endemic *Ophrys sphegodes subsp. epirotica*, the remaining 18 orchid species have a wide general distribution covering several areas in Europe (Tutin et al., 1980). Regarding Labiatae taxa, animal and wind dispersal without special adaptations are most commonly adopted. For *Stachys* sp. vegetative methods (through rhizomes) have also been reported (Harley et al., 2004). Seeds of Caryophyllaceae taxa are also usually dispersed through animals and the wind, while ant dispersal has been observed for *Silene* sp. (Kubitzki et al., 1993).

The significance of a small population size is especially important for plants, such as orchids, which depend on mutualistic relationships with pollinators for reproductive success (Costin et al., 2001). Nevertheless, most of the rare/protected/endemic plant taxa recorded along the route are very likely to be relatively abundant within the study area as a whole and not limited to the working strip row itself. As a result, the fact that the primary forests along the working strip will remain at their pre-construction status plus the fact that several (if not all) of the identified rare/protected/endemic species have been recorded also outside the working strip supports the opinion that seed sources will replenish the impacted populations after construction is completed.

Based on the above, it is assumed that no particular mitigation measures need be employed during or after the construction of the working strip provided that the neighbouring forest and vegetation remain at their pre-construction status and that they are not affected at all. Nevertheless, adopting a reduced working strip will reduce both the impact on the flora populations as well as the impact on the habitats (see the corresponding paragraph 8.7.2.2.1).

A monitoring scheme following the BACI (Before – After – Control – Impact) framework will be developed to assess, in a quantitative way, the pre-construction and the post-construction condition of certain flora community parameters and also provide information in the unlikely event that certain species are in need of particular intervention measures to recover in the area.

**Impact on reptile/amphibian populations**

1 the BACI concept is to examine the Before (pre-construction baseline) and After (post-construction) condition of the area, as well as to compare a Control (reference site) with the Impact site (reinstated site). Beforeand Aftersampling will determine how the restoration process changed the site through time. Control and Impact sampling will allow effects of restoration actions to be discerned from natural variability and underlying trends in the larger area. A Control site which has identical conditions to the Impact site is not typically available. Thus, we use the term Reference site (see Smith et al. 1993) to describe areas near the restoration but not part of the area directly affected by the restoration project. The restoration and reference sites are typically monitored with similar intensity to allow for direct comparison of the different monitoring samples. (Retrieved by [http://www.tidalmarshmonitoring.org/monitoring-design-before-after-control-impact.php](http://www.tidalmarshmonitoring.org/monitoring-design-before-after-control-impact.php), on 02.06.2013)
• A pre-construction inspection of the areas to be cleared will allow the removal and manual transfer of observed tortoises to nearby locations. This is expected to reduce direct mortality.

• Development of communication activities and preparation of a plan targeted to workers in order to reduce direct killing of reptiles. Workers can also be trained to remove and manually transfer species to nearby locations.

• Ideally all construction activities requiring removal of forest vegetation should be programmed in order to minimize disturbance of species engaging in reproductive activities during late spring.

• Apply a monitoring programme under the BACI framework to assess the tortoise populations’ condition along the pipeline working strip.

*Impact on European ground squirrel (Spermophilus citellus) colonies*

A monitoring scheme following the BACI framework should be developed to assess in a quantitative way the status of colonies within the working strip or in its immediate vicinity just prior to construction. Field surveys indicate a high turnover rate for several of these colonies which mean that current agricultural processes along the pipeline route may be adequate to ensure temporary displacement of the colonies during construction (see also procedures described in Hertweck (2012)). This however cannot be verified unless a monitoring scheme is developed on-site prior to construction.

8.7.2.3 Residual Impacts

Up to this section, the assessment has generally described unmitigated impacts. However it should be noted that the pipeline route selection is one of the main mitigation measures for the project – allowing impacts on the biological, physical, socio-economical and cultural heritage environment to be minimised.

The following table assesses the significance of project impacts after the implementation of the described mitigation measures. These mitigation measures will be captured within the ESMMP. This is a document which will be part of the contractual obligations of the contractor building the pipeline, the operators of the system and ultimately the contractor carrying out the decommissioning activities.
Table 8-50 Residual Impacts - Terrestrial Ecology – Construction and Pre-commissioning Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
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<tr>
<td><strong>Construction Phase</strong></td>
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<tr>
<td>Habitat Loss per Habitat 92/43/EEC</td>
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<td></td>
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<tr>
<td>Agricultural land (1020)</td>
<td>- Establishment of working strip to restrict area of impact to within working corridor; - Access road upgrading will follow existing tracks and trails where possible; - Construction facilities to be sited on unused land of no particular ecological value; - No construction materials will be taken from the surrounding environment unless approved by the competent authority; - Restoration of sites to baseline condition where possible upon completion of construction - Establish a pre and post construction biodiversity baseline from which all mitigation, restoration, and loss / degradation can be measured; - Work to retain passage for species as long as possible across the corridor - Translocate important flora species to other suitable areas; - Micro-siting of the route to be done, where possible, for best position available for biodiversity - Habitat compensation measures should be considered where required; - Work to be supervised by an on-site Ecological Clerk of Works (ECoW); - Ecological awareness training should be provided to all personnel; and - Establish a Forest Fire Risk Prevention Plan.</td>
<td>NOT SIGNIFICANT</td>
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<tr>
<td>Urbanized areas (1050)</td>
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<td>Unvegetated sand beds (1061)</td>
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<tr>
<td>South-eastern sub-mediterranean deciduous thickets (5160)</td>
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<td>Garrigues of eastern Mediterranean (5340)</td>
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<tr>
<td>Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (6210)</td>
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<tr>
<td>Mediterranean subnitrophilous grasslands (6290)</td>
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<tr>
<td>Eastern sub-mediterranean dry grasslands (62A0)</td>
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<td>Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion (6420)</td>
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<tr>
<td>Greek hyper-mediterranean humid grasslands (6450)</td>
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<tr>
<td>Calcareous rocky slopes (8210)</td>
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<td></td>
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<tr>
<td>Reforestations (1030)</td>
<td>- Establishment of working strip to restrict area of impact to within working corridor; - Implementation of a reduced working strip (28 m) through sensitive habitats (European or Greek habitats), as required; - Implementation of the minimum working strip (18 m wide) through the crossing of Priority European Habitats (i.e. 91E0*) - Pre-construction habitat surveys to identify temporary, dynamic habitats (e.g. 3170). - Access road upgrading will follow existing tracks and trails where possible; - Construction facilities to be sited on unused land</td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td>Mediterranean temporary ponds (3170)</td>
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<tr>
<td>Lakes of gypsum karst (3190)</td>
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</table>

NOT SIGNIFICANT: Currently, this habitat type is not crossed by the pipeline. Nevertheless, the areas known to host this habitat along the pipeline route (Kompasatos River and Nestos River) are currently foreseen to be crossed with the use of a trenchless technique (such as HDD). Consequently, residual impacts are assessed as not significant.
**Impact / Risk** | **Measures to Address the Impact / Risk** | **Significance of Residual Impact / Risk**
--- | --- | ---
Constantly flowing Mediterranean rivers with Paspalagoastrostion species and hanging curtains of *Salix* and *Populus alba* (3280) | of no particular ecological value; | MODERATE (potential to be NOT SIGNIFICANT in case of trenchless crossing) |
Annual river mud communities (32B0) | • No construction materials will be taken from the surrounding environment unless approved by the competent authority; | |
Arborescent matorral with *Juniperus* spp. (5210) | • Restoration of sites to baseline condition where possible upon completion of construction | |
Pseudomaquis (5350) | • Establish a pre- and post-construction biodiversity baseline from which all mitigation, restoration, and loss / degradation can be measured; | |
Reedbeds (72A0) | • Work to retain passage for species as long as possible across the corridor | |
Asperulo-Fagetum beech forests (9130) | • Translocate important flora species to other suitable areas; | |
Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (91E0, Priority habitat) | • Micro-siting of the route to be done, where possible, for best position available for biodiversity | |
Thermophilous oak woods of E Mediterranean and Balkans (924A) | • Habitat compensation measures should be considered where required | |
*Quercus trojana* woods (9250) | • Work to be supervised by an on-site Ecological Clerk of Works (ECoW); | |
*Salix alba* and *Populus alba* galleries (92A0) | • Ecological awareness training should be provided to all personnel; and | |
*Platanus orientalis* and *Liquidambar orientalis* woods (92C0) | • Establish a Forest Fire Risk Prevention Plan. | |
*Quercus macrolepis* forest (9350) | • Establish a Reinstatement Study prior to any construction work beginning. | |
Mediterranean pine forests with endemic Mesogean pines (9540) | • In selected major river crossings, a trenchless technique (such as HDD) will be investigated in order to minimize impact on riparian vegetation. | |
| | • If requested, construction strip will be formatted as a fire protection belt. | |

**Habitat Fragmentation**
### Impact / Risk

**Habitat fragmentation**

(KP 21-31, 47-50, 52-57, 59-61, 115-123.7, 183-193, 296-310, 430-432.5, 434.5 – 437.5, 439-445.6, 491.3-492.3, 495-496, 499-500, 538.3, 538.8, 541.5, 542, 544)

- Implementation of a reduced working strip, as required
- No secondary works/new roads should be undertaken/constructed, especially inside stream valleys, to the extent that is possible.
- No temporary or permanent facilities should be constructed or the passage of heavy machinery allowed with the exception of main forest roads
- Traffic should be limited to main forest roads to the extent that is possible.
- Avoid blasting activities where possible along these areas.
- Avoid dawn/dusk day periods to the extent that is possible.
- Avoid destroying stands of mature trees
- In all identified sensitive areas works should be avoided between mid-March to end of July and dawn or dusk to the extent that is possible.

**Significance of Residual Impact / Risk**

MINOR: in addition to the mitigation measures for habitat loss, impacts on habitat fragmentation will be minor

### Disturbance or Displacement (General Construction Activities, and Blasting and Hammering Activities)

**Disturbance of Canis lupus** (KPs 29-31.2, 47-50, 52-57, 59-61, 189-191, 296-310, 428-432 and 439-441)

- No construction works should be performed on these areas of high suitability habitats for wolves from mid-March to end of July to the extent that is possible;
- Heavy machinery and traffic will be limited to using main forest roads and the existing DESFA RoW, as much as possible.
- Avoid dawn-dusk and night-time works
- The pipeline installation should follow and be as close to as possible or within the existing DESFA ROW strip width
- Avoid blasting activities on these areas to the extent that is possible.
- No auxiliary facilities should be constructed or artificial lighting installed within these areas.
- Avoid destruction of stream riparian vegetation by the adoption of a reduced working strip and use of existing natural corridors and forest openings, to the extent that is possible.
- A Biodiversity Action Plan (BAP) will be implemented as part of the ESMMMP

**Significance of Residual Impact / Risk**

MODERATE to MINOR: the construction restrictions and mitigation measures will alleviate the disturbance factors. Impacts will be temporary.
### Impact / Risk

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| Disturbance of *Canis aureus* (KPs 0-3, 34-35, 117-126, 150-159, 282-295) | - Avoid construction works between March and July, in areas suitable for jackal, to the extent that is possible  
- No temporary facilities constructed.  
- No passage of heavy machinery or traffic should be allowed except on main existing roads to the extent that is possible.  
- Vehicles should move with a low speed within the area.  
- Where possible, avoid blasting activities.  
- Where possible avoid dawn/dusk day periods.  
- Avoid destroying riparian and shrub vegetation to the extent that is possible.  
- A Biodiversity Action Plan (BAP) will be implemented as part of the ESMMP | **MINOR**: the construction restrictions and mitigation measures will alleviate the disturbance factors. Impacts will be temporary. |
| Disturbance and displacement of *Ursus arctos* individuals (KP 439.5 – 445.6, Kleisoura area, KP 527 – 529, KP539 – 543) | - Avoid construction of roads inside this area so as not to permanently reduce habitat quality  
- Unse a minimum possible working strip to eliminate destruction of refugia and bear habitats of regular use  
- Avoid temporary facilities  
- Impose seasonal constrains | **MODERATE**: impacts of moderate significance are expected in relation to potential destruction of bear habitats. |
| Disturbance of *Circus pygargus* during breeding | - Field visit along KP 529 to 534 in case of summer works and delay of works only if a nest is located within 200 m from the working strip | **NOT SIGNIFICANT**: if construction period restrictions are imposed (April to August) |
| Disturbance of birds during breeding (KPs 227-230, 236.4-238.5, 350.5-355.5, 323.5-327.5) | - Where possible undertake vegetation clearing before or after breeding season, i.e. before 1st March or after September 30th  
- Discourage bird breeding on pipeline route sections with important breeding birds habitats (by installing plastic bands fluttering in the wind before breeding season starts (March 1st)  
- Pre-construction surveys to be carried out by ornithologist. Avoidance of work or relocation of nest, according to species.  
- Avoid construction works from March to July | **NOT SIGNIFICANT** |
### Impact / Risk

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| Disturbance of birds during breeding season | • Where possible undertake vegetation clearing before or after breeding season, i.e. before 1st March or after September 30th.  
• Discourage bird breeding on pipeline route sections with important breeding birds’ habitats, by installing plastic bands flatterling in the wind before breeding season starts (March 1st).  
• If it is a necessity to clear vegetation within the period 1st March-31st July (bird breeding season) pre-vegetation clearance surveys will be undertaken by ornithologist. Should nests of species of conservational interest be located, no works will be carried out at least within 25 m buffer from the nest (or greater depending on the species) until chicks have fledged from it or it is naturally abandoned. Avoidance of work or relocation of nest, according to species.  
• The adoption of a construction restriction period between March and July will be considered for the main breeding areas identified along the route with special attention to the Loutros forest (KP 29-32).  
• The adoption of additional construction restriction period between October and end of March may be considered for the section from KP 29 to 32 (Loutros forest) and reed beds at KP 159.7 due to the presence of wintering species such as the spotted eagle and the moustached warbler respectively. Such restrictions should be validated by a special ornithological study prior to construction for these two species. | NOT SIGNIFICANT |

### Species- Population Loss

| Impact on protected/rare/endemic flora species | No need for Project Actions  
Reduced working strip in some cases | NOT SIGNIFICANT |
| Impact on reptile/amphibian populations | A quick inspection of the areas to be cleared for manual transfer of observed tortoises  
Training of workers.  
BACI monitoring programme for tortoise populations’ condition along the pipeline working strip. | NOT SIGNIFICANT |
| Impact on Spermophilus citellus colonies | Quantitative BACI monitoring scheme for the status of colonies within the working strip or in its immediate vicinity prior to construction.  
Examine feasibility and the possible risks of translocating the population of colonies identified along the working strip.  
Assess colony status prior to construction and employ temporary displacement procedures  
A Biodiversity Action Plan (BAP) will be implemented as part of the ESMMMP | MINOR: Temporary displacement of colonies has been proved to be successful in ensuring non-detrimental removal of animals just prior to construction. |

8.7.3 Operation and Maintenance Phase

8.7.3.1 Potential Impacts

8.7.3.1.1 Habitat Fragmentation

Wolf (Canis lupus)

Along forested areas where wolves have been recorded, such as Kavala Mountains (KP 189 - 191), Kroussia Mountains (KP 296 - 310), and Vermio Pass (KP 425 – 445), the pipeline working strip even in its reduced version (28 m instead of 38 m) could create some minor edge effects and reduce habitat suitability. Specifically, it could increase forest fragmentation thus reducing habitat suitability of the area in the long term and during the operation phase. However, the Pipeline Protection Strip (PPS) (8 m), which will be kept clear from deep rooted species is not much wider than a typical Greek forest road (6 m wide), and thus is considered to be really limited in its impact. In addition reforestation could take place along the working strip with the only exception being that of the PPS. These effects are not expected to occur at in Southern Evros section (KP 29 - 32) due to the already existing DESFA pipeline protection strip.

The impacts of fragmentation in the habitat areas of high suitability for wolves are considered to be of small magnitude. Although wolves may abandon their habitat altogether due to disturbance and avoid re-colonization if fragmentation levels reduce habitat suitability, the fragmentation potentially generated is considered to be as small as the PPS and is not much different than a forest road whilst it is smaller than a fire belt.

As mentioned in Section 6 (6.3.3.2.2), the wolf in Greece is considered Vulnerable according to the Red Data Book – Greece (with a population of only about 600 individuals). Although the European Habitats Directive identifies Canis lupus as a “priority species”; and a “species of community interest in need of strict protection“ for the Greek wolf populations in the south of the 39th parallel (i.e. Central Greece), there is no special designation for wolves in Northern Greece. Assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact should be assessed as being minor. Residual impact, after the implementation of the mitigation measures is summarized in the Section 8.7.2.3.
Jackal (*Canis aureus*)

As previously described, the jackal is known to be an adaptable species, whenever the disturbance is temporary and short term and does not change habitat quality and food availability. The clearance of the PPS will have no negative impact, if not positive, on the habitat quality of the jackal. Jackals would be benefitted somewhat from the creation of small openings along the thick scrubs (see *Annex 6.5.9*). Consequently, no impacts are assessed due to habitat fragmentation to the jackal, during operation.

8.7.3.1.2 Disturbance and Displacement of Fauna Species

**Bear (Ursus arctos)**

Possible permanent alterations due to breach of isolation could be argued for the locations 439.5 - 445.6, KP 527 – 529 and 538.8 – 543.2. Nevertheless, the only area that will be permanent breached is the 8 m wide Pipeline Protection Strip. This can be considered as a natural opening in the forest habitat, especially for big mammals, such as the bear. The magnitude of the impact to the bear population in the areas of Vermio Pass, Kleisoura Pass, Aliakmonas River crossing and the Greek/Albanian border is considered to be small. As the species is of high sensitivity being protected under Greek legislation and is an “endangered” species according to the Red Data Book – Greece while it is also identified as a “priority species” and a “species of community interest in need of strict protection” by the Habitats Directive (Annexes II and IV), the impact significance is here considered to be moderate, assuming that no mitigation measures are applied or embedded in the design of the project. Residual impact, after the implementation of the mitigation measures is summarized in the *Section 8.7.2.3*.

Jackal (*Canis aureus*)

The operation of the compressor station within or in the vicinity of the jackal territory is expected to result in a long-term disturbance on the jackal pack inhabiting the surrounding area due to the noise emitted by the operation of the Compressor Station GCS00. As previously described, vegetation clearance is not expected to cause impacts on the jackal population, mainly due to the location of the Compressor Station on agricultural land.

The location of GCS00 is next to the existing DESFA facilities, bundling with them very closely. As described in the relevant section for noise (see section 8.3), the noise of GCS00 is not
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Document Title: Section 8 - Assessment of Impacts and Mitigation Measures

affecting the social sensitive receptors. Although it is unclear which noise levels would drive the jackal away, it is estimated that the 45 dB(A) noise contour is an acceptable noise pressure for the jackal. This noise level of 45 dB(A) is reached at approximately 500 m from the fence line. Consequently, the magnitude of the impact is deemed to be small. Given that the sensitivity of the receptor is high and assuming that no mitigation measures are applied or embedded into the design of the project, then the significance of the impact has been considered to be moderate. Residual impact, after the implementation of the mitigation measures is summarized in the Section 8.7.2.3.

Birds
The pipeline itself will create openings in some areas that could be beneficial for many species of birds. Nevertheless, the operation of the compressor station could cause some disturbance and displacement, due to the noise emitted. Currently, there are no valid, acceptable noise pressure levels which would cause avifauna to be displaced. Nevertheless, species are likely to be displaced from the vicinity of the two compressor stations. In studies of traffic noise\(^1\) it has been assessed that noise could change foraging behaviour and diminish reproductive success, making it more difficult for birds to establish and maintain territories, attract mates and maintain pair bonds, and possibly lead to reduced breeding success in noisy roadside habitats.

None of the planned compressor stations is located in avifauna hotspots. However, during the field surveys, only in GCS01 was a pair of Hobby (\textit{Falco subbuteo}) identified. The sensitivity of the receptor is high but the magnitude is small as the habitat availability for the species is widespread in the area and the species does not exhibit nest fidelity behaviour. Assuming that no mitigation measures are applied or embedded into the design of the project, the significance of the impact should be assessed as being minor to moderate. Residual impact, after the implementation of the mitigation measures is summarized in the Section 8.7.2.3.


8.7.3.2 Mitigation Measures

TAP AG will analyse, in the framework of the *Biodiversity Action Plan* (see Section 9.3), the possibility of financing or supporting in other ways the investigation, monitoring and conservation of species, habitats or areas of high environmental interest located in this section or other sites located in the vicinity of the study area.

The maintenance and patrolling activities along the Pipeline Protection Strip will take into account faunal sensitive periods in order to reduce potential disturbance.

Details on the mitigation measures for noise during operation of the Compressor Stations are provided in Section 8.3. All measures presented there are applicable for fauna as well.

8.7.3.3 Residual Impacts

<table>
<thead>
<tr>
<th>Table 8-51</th>
<th>Residual Impacts - Terrestrial Ecology – Operations Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact / Risk</td>
<td>Measure to Address the Impact / Risk</td>
</tr>
<tr>
<td>Habitat Fragmentation/ Edge effects of <em>Canis lupus</em> individuals</td>
<td>• Biodiversity Action Plan</td>
</tr>
<tr>
<td>Disturbance and displacement of <em>Ursus arctos</em> individuals</td>
<td>• Biodiversity Action Plan</td>
</tr>
<tr>
<td>Disturbance and displacement of <em>Canis aureus</em> individuals (GCS00)</td>
<td>• Biodiversity Action Plan</td>
</tr>
<tr>
<td>Disturbance and displacement of <em>Canis aureus</em> (GCS00)</td>
<td>• Biodiversity Action Plan</td>
</tr>
</tbody>
</table>
8.7.4 Decommissioning Phase

8.7.4.1 Potential Impacts

It is expected that the same type of equipment, machinery and vehicles, with the ones used for construction, are to be used during decommissioning. It cannot currently be foreseen which approach will be taken at the time of decommissioning, but TAP AG is committed that this will be state-of-the-art at the time when it occurs. Any decommissioning activities will be subject to permitting requirements applicable at that time and subject to consultation with affected owners and stakeholders of affected properties and structures.

A Pipeline Abandonment Plan that covers all relevant items will be prepared before any decommissioning works. Impacts will obviously depend on the decommissioning approach and available dismantling techniques at that time. International present practice is to leave a pipeline in the ground (abandonment-in-place), and secure it against structural collapse which will cause ground subsidence. In that case, the impacts on the environment, land use and infrastructures will be minimal. If the pipeline was to be taken out of the ground at the time of decommissioning (e.g. to recover the pipe steel) then the impacts will be similar to the construction stage.

8.7.4.2 Mitigation Measures

Measures to reduce impacts during decommissioning will be similar to those outlined for construction.
8.7.4.3 Residual Impacts

Residual impact by decommissioning will be similar to the ones during the construction phase, but of an even lower magnitude. Table 8-50 for residual impacts from construction can also be applied to the decommissioning phase.

8.7.5 Summary of Impacts on Terrestrial Ecology

Vegetation, Flora and Habitat
A large proportion of habitat in the areas crossed by the pipeline route is highly modified, fragmented and disturbed. Out of the total of about 2064 ha within the regular working strip approximately 1,637 ha are agricultural lands (i.e. 79% of the working strip). These sections should be easy to restore after the temporary construction work activities. Approximately 280 ha are forests and shrublands, which is approximately 13.5% of the regular working strip. Certain key areas have however been identified along the route in which areas of high ecological value are present. The total loss of Greek or EU-listed habitats from the regular working strip footprint amounts to about 376 ha (i.e. 18% of the regular working strip). Additionally, habitat loss will occur in those areas required for the permanent and temporary facilities such as the BVSs, the storage yards, the construction camps and where access roads are upgraded.

Vegetation will be allowed to re-establish after construction works are completed along the construction strip. The construction strip will be reinstated to its former condition as much as possible. However, in the 8 m pipeline protection strip, to protect pipeline integrity, only annual crops or low vegetation will be allowed so as to provide access possibilities for pipeline route inspections and maintenance activities; this restriction totals about 434.4 ha over the 543 km pipeline route in Greece. Thus in areas where the pipeline passes through natural or semi-natural environment, this pipeline protection strip will not be able to regenerate over time to the original habitat type unless the vegetation type is grassland or similar. Losses of vegetation of ecological significance especially Macedonian oak (Quercus troiana) will occur in Southern Evros, Kavala Mountains, Kroussia Mountains and Vermio Mountain. In Vermio Mountain beech forests are also going to be impacted, whilst in Southern Evros pine forests will be effected. Impacts on mature forest will be reduced by applying a reduced working strip (28 m width) to the extent that constructability and construction logistics will permit.
In addition, at certain watercourse crossings the European priority habitat 91E0 (riparian alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*), i.e. a total area of 0.3 ha, will be affected. The adoption of a trenchless crossing technique at these crossing locations, where it is technically feasible, will avoid impacts on the priority habitat. Impacts on riparian forest habitats where open-cut techniques are applied will be reduced through the adoption of a reduced working strip as is the case for the Grammatiko stream. Adaptation of such trenchless techniques in selected major rivers will also decrease impact on other riparian forested areas.

Further, transplanting of plant specimens from the working strip will be considered if relevant protected or endemic species are found to be present along the working strip; this is limited however to species for which re-growth success is unlikely. Losses of natural and semi-natural vegetation will be mitigated by habitat restoration or replacement, i.e. replanting the temporary affected footprints with regional plant species and seeds. These measures will be detailed in the *Site Restoration Plan*.

**Fauna**

*Construction and Pre-Commissioning Phase:*

The pipeline route traverses a range of fauna habitats inter alia mammals and birds. The presence of workers and machinery, noise and vibration from activities (in particular from hammering and blasting sections) have a great disturbance potential to certain species especially in the more remote sections of the route. This will therefore be minimised by avoiding sensitive times, such as breeding / reproduction or wintering / hibernation periods when construction activities are scheduled at relevant pipeline sections. Further on, works on construction sites are usually foreseen to take place during daytime hours.

The more remote parts of the route are habitats for large mammals including brown bear, golden jackal and grey wolf. In order to minimise disturbance of the wolf population, construction will be avoided between mid-March through to the end of July and between dawn and dusk to the extent that is possible on the areas where wolf presence and reproduction have been confirmed (Southern Evros, Kavala and Kroussia Mountains, Vermio Mt., Kleisoura and Greece-Albania border area). Other protected species, as the brown bear, are sensitive to construction disturbance. This species is especially sensitive during denning (winter) and rearing (spring) seasons, and construction works may lead to abandonment of dens in the vicinity of the pipeline. Main areas of concern are the Vermio and Kleisoura passes, Aliakmonas River crossings, and
the Greek/Albanian border. It is therefore foreseen for these sections that the working strip would be reduced in forest habitats to the extent that is possible and to consider avoiding construction works between March and August. As the golden jackal occupies regions in the eastern section of the pipeline route that are the areas of its greater expansion in Evros, Xanthi and Serres prefectures, all appropriate preventive and mitigation measures will be applied within these sections of the pipeline route (e.g. Construction works restriction period during February and July, or from dusk till dawn will be considered).

The pipeline route traverses a range of bird habitats. As indicated above at relevant sections along the route, e.g. KP 29 – 32, 268, 280.6, 290 – 290.6, 323.5 – 327.5, 350.5 – 355.5; bird breeding will be discouraged by installing plastic bands (e.g. warning tape) that flutter in the wind, before the breeding season starts (i.e. before March 1st). In order to avoid any disturbance to species during the breeding season, which may further lead to the abandonment of nests and breeding failure, vegetation clearance works should start if possible before the breeding season. One site of major interest for bird breeding and wintering protected bird species will be crossed i.e. Loutros forest, KP 29 – 32. The establishment of a construction restriction period for this site will be considered. i.e. construction works should be avoided from March to July and, if possible, during winter (December to March) as well. This restriction will also be considered for all bird habitats of interest identified, but limited to the breeding period. In addition, pre-construction surveys will be undertaken to check for nests. Special attention will be paid to the protected Montagu’s Harrier which has been observed in the area around Mesopotamia between KP 529 and 534.

The baseline has identified several sections of the pipeline route, where on agricultural land, fallow land and meadows, evidence of the European Ground Squirrel (*Spermophilus citellus*) colonies is present. However, colonies may be changeable from year to year (i.e. 7 tunnel systems were recorded in summer 2011, but in spring 2012 there was evidence found of only 2 active colonies was found). In order to avoid mortality of colony populations during working strip preparation a pre-construction survey will be conducted so as to identify any potential active burrows. Specifically for KP 341 - 343 where two systems of burrows were recorded NW of Drymos Village, both being within the 500 m corridor, in a fallow field and a meadow respectively, among large cereals' fields, an intensive pre-construction field survey in a mid-summer period will be conducted. This field survey will seek to define the persistence and the real extent of the
colony, even outside of the 500 m buffer zone, in order to avoid damage to the species if a colony is verified. Relocation of any colony located within the working strip will be investigated.

Direct mortality may affect small mammals and reptiles (e.g. tortoise) and amphibian individuals by construction activities along the working strip or pipe truck traffic on the access routes and machinery movement on the working strip. However, due to the temporary nature of the activities on the pipeline spreads, no threats to populations are anticipated.

It is highlighted that TAP will establish a Biodiversity Action Plan which will detail the mitigation measures for faunal species. TAP will also ensure that reinstatement will take place immediately after each pipeline section is constructed (to the pre-construction conditions to the maximum feasible extent). In addition, it should be taken into consideration that (i) TAP has gone through an elaborated route refinement process, which provides the most overall significant mitigation measure, (ii) the pipeline will be buried, and consequently not be acting as any barrier whatsoever, and that (iii) construction works will be temporary.

**Operation and Maintenance Phase:**

The main impact on biodiversity during operation is due to the maintenance of the pipeline protective strip which involves periodic clearing of vegetation. In order to avoid disturbance to fauna during operation, the schedule and mode of pipeline route patrols and any activities to keep the pipeline protection strip from deep rooting permanent vegetation will need to consider sensitive fauna periods. Noise minimization measures have been embedded within the design of the project and have assured minimum, if any, impact to sensitive receptors.

A Biodiversity Action Plan will be adopted together with proper restoration of the working strip.

### 8.8 Freshwater Ecology

#### 8.8.1 Overview

The route between the Greek/Turkish border and the Greek/Albanian border crosses several hundred watercourses. Among these are large rivers such as Evros, Filiouris, Kompasatos, Nestos, Aggitis, Strymonas, Axios and Aliakmonas\(^1\), several channels and creeks, and the

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\(^1\) Three crossing points (Aliakmonas I, Aliakmonas II, ALiakmonas III (Vrachopotamos))
During the development of the pipeline route, the Project has sought to avoid, minimise and mitigate impacts on Freshwater Ecology through the route selection, route-refinement and final assessment. In addition, the project design has also included considerations on crossing technologies. As described in Section 4.4.5, open-cut crossings will be the standard construction technique for watercourse crossings. However, the engineering feasibility of trenchless crossing was also studied, based on the ecological sensitivities identified in the baseline study (refer to Sections 6.3.2 and 6.3.3) which not only includes water ecology, but also riparian vegetation and forests, and importance for terrestrial fauna and birds.

Overall, the aim of this process was to avoid, to the extent that is possible, any relevant interference with water courses that maintain or support valuable species of fishes or other taxa (such as the otter) and/or that have valuable riparian forests/habitats. Other environmental indicators such as macroinvertebrate and diatom indicators were also used to complete the evaluation of the river (Section 6.3.2.5 on Aquatic Ecology). These indicators are also key to the river ecosystem as they are indicative of the water quality status (by integrating the water quality over time), they are an integral part of the river, and also serve as food to other taxa such as the fishes or birds (mainly insectivorous birds).

In the sections below an evaluation on the potential impacts to the aquatic ecosystem is presented. The evaluation has been based on the information compiled during the desktop and field investigations. The field investigations focussed on a selection of 20 medium to large sized rivers as these were considered as having the highest ecological potential (i.e. permanent waters) and also because in those construction operations the impacts would be expected to be more significant.

*Table 8-52*, below, provides a compilation of the following information:

- Key environmental indicators of interest for the aquatic environment for each river crossing (see Annex 6.5.7 for details on the indicators and field activities).
- Comments/remarks on the river to complement the indexes.
<table>
<thead>
<tr>
<th>River</th>
<th>Preliminary Freshwater fish Index of Biotic Integrity</th>
<th>European Fish Index</th>
<th>Macroinvertebrate (HES) index</th>
<th>Diatom index IPS</th>
<th>Comments – Conclusions</th>
<th>Design Crossing Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evros</td>
<td>Moderate</td>
<td>N/A</td>
<td>Poor</td>
<td>Poor</td>
<td>An ichthyofaunal – rich site nevertheless the alien species’ presence is relatively high. Species of interest were rather scarce in numbers.</td>
<td>Trenchless river crossing (crossing method confirmed)</td>
</tr>
<tr>
<td>Provatonas (Kipoi)</td>
<td>N/A</td>
<td>N/A</td>
<td>Poor</td>
<td>Poor</td>
<td>This site has the peculiarity that it might serve as an important spawning and foraging area for fish taxa in spring and early summer (species from the Evros are expected to enter the Provatonas). Water flow nevertheless becomes too little at the end of the dry season and then the site is abandoned by freshwater fish populations.</td>
<td>Dry' open-cut crossing during low flow period (Crossing method confirmed)</td>
</tr>
<tr>
<td>Fytemata (Mega Rema)</td>
<td>Bad</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Strongly impacted by irrigation (expected to dry out at the end of the dry season) No fish present in reach and this is due to artificial desiccation (altering flow regime).</td>
<td>Dry' open-cut crossing during low flow period (Crossing method confirmed)</td>
</tr>
<tr>
<td>Apokrimno (Eirini)</td>
<td>Moderate</td>
<td>N/A</td>
<td>Poor</td>
<td>Moderate</td>
<td>The site is assessed to be of moderate quality with regards to the freshwater fish populations. It is one of the few streams within the entire Evros region with permanent waters. Non indigenous species are present in low numbers, migratory fish are absent and some stagnophilous species that are expected are also absent. Nevertheless the metrics show that the site is close to the moderate-good boundary.</td>
<td>Dry' open-cut crossing during low flow period (Crossing method confirmed)</td>
</tr>
<tr>
<td>Filouris (Lissos)</td>
<td>Good</td>
<td>N/A</td>
<td>Moderate</td>
<td>High</td>
<td>Fish populations are at rather high densities: good populations of <em>Alburnus vistonicus</em> are recorded, a CR local endemic species for IUCN and the Red Data Book– Greece. A few more species are expected in this section of the river (e.g. <em>Petroleuciscus, Salaria, Rutillus, Anguilla Anguilla</em>) but these could not be confirmed. Total absence of alien species being present increased the assessment rating rising it to near the good-high boundary.</td>
<td>Trenchless river crossing (Crossing method confirmed)</td>
</tr>
</tbody>
</table>
### River | Preliminary Freshwater fish Index of Biotic Integrity | European Fish Index | Macroinvertebrate (HES) index | Diatom index IPS | Comments – Conclusions | Design Crossing Technique
---|---|---|---|---|---|---
Chironorrema (Bosbos, Bosbozis) | Poor | N/A | Poor | Bad | Limited data on freshwater fish populations. The site is considered strongly impacted by water pollution. There is not enough ichthyological information to further assess site conditions or integrity. Former HCMR research downstream of the site has documented a degraded fish community; pollution and surface water abstraction being key problems. | 'Dry' open-cut crossing during low flow period (Crossing method confirmed)
Aspropotamos | Moderate | N/A | N/A | High | The fish community is dominated by few tolerant species. Size and age-classes of all fish are restricted to young stages only. There is speculation that the site is strongly impacted by water abstraction. | 'Dry' open-cut crossing during low flow period (Crossing method confirmed)
Kompasatos (Xiropotamos) | Moderate | N/A | N/A | Good | The site is intensively anthropogenically impacted due to gravel-mining upstream and significant water abstraction. Barriers to fish. A fish community with high population densities but missing several species; and with its most threatened species in very low numbers. | Trenchless river crossing (crossing method confirmed)
Kosinthos (Xanthis) | Good | N/A | Moderate | Good | The water level of the site is probably anthropogenically impacted and lowered; Possibly due to existing barriers to fish migratory rheophilous species are found in very low numbers. Nevertheless fish community shows high population densities, although several species are missing and those threatened show very low numbers. | 'Dry' open-cut crossing during low flow period (Crossing method confirmed)
Nestos | N/A | N/A | N/A | High | Literature data indicate that this is a site of major ichthyological interest. Data from HCMR's research in the recent past shows that it is a fairly rich environment for fishes. | Trenchless river crossing (crossing method confirmed)
Tafros of Aggiti (of Filippoi) | Good | N/A | Poor | Good | Fish populations were very dense with limited size-class variation showing a predominance of small-sized specimens in the inshore parts of the channel. Shoreline habitats are rich in plants and diverse. | 'Dry' open-cut crossing during low flow period (Crossing method confirmed)
<table>
<thead>
<tr>
<th>River</th>
<th>Preliminary Freshwater fish Index of Biotic Integrity</th>
<th>European Fish Index</th>
<th>Macroinvertebrate (HES) index</th>
<th>Diatom index IPS</th>
<th>Comments – Conclusions</th>
<th>Design Crossing Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggitis</td>
<td>Good</td>
<td>N/A</td>
<td>Moderate</td>
<td>High</td>
<td>It is expected to be a relatively ichthyofaunal-rich site. Fish populations were very high and dense during the sampling.</td>
<td>Trenchless river crossing (crossing method confirmed)</td>
</tr>
<tr>
<td>Tafros Belitsa / Mitrousi</td>
<td>N/A</td>
<td>N/A</td>
<td>Poor</td>
<td>Good</td>
<td>The water body is on a channelized small stream. This would probably be a site poor in fish species-richness and heavily modified by total channelization.</td>
<td>Dry' open-cut crossing during low flow period (Crossing method confirmed)</td>
</tr>
<tr>
<td>Strymonas</td>
<td>N/A</td>
<td>N/A</td>
<td>Poor</td>
<td>Moderate</td>
<td>The water body is on a wide almost meandering part of the Strymon with a narrow floodplain banked by high embankments.</td>
<td>Trenchless river crossing (crossing method confirmed)</td>
</tr>
<tr>
<td>Galikos</td>
<td>Moderate</td>
<td>N/A</td>
<td>Moderate</td>
<td>Good</td>
<td>Many barriers influence migratory rheophilious fish. The fish community is dominated by non-Indigenous species with a suppressed occurrence of the species that should dominate at this site.</td>
<td>Dry' open-cut crossing during low flow period (Crossing method confirmed)</td>
</tr>
<tr>
<td>Axios</td>
<td>Good</td>
<td>N/A</td>
<td>Good</td>
<td>Moderate</td>
<td>The freshwater fish and the macroinvertebrate indices show that the aquatic communities at Axios crossing point are in a very good state and several protected species thrive there (including Balkan endemic fishes).</td>
<td>Trenchless river crossing (crossing method confirmed)</td>
</tr>
<tr>
<td>Vrardarovasi</td>
<td>Bad</td>
<td>Poor</td>
<td>Bad</td>
<td>Moderate</td>
<td>There is a consensus of all the indices in the status of Vrardarovasi stream: its current state indicates strong deterioration of several ecological attributes</td>
<td>Trenchless river crossing (crossing method confirmed)</td>
</tr>
<tr>
<td>Channel 66</td>
<td>Good</td>
<td>N/A</td>
<td>Poor</td>
<td>Good</td>
<td>Freshwater fish populations comprise several protected species, including protected and Balkan endemic fish species.</td>
<td>Trenchless river crossing (crossing method under review by design team)*</td>
</tr>
</tbody>
</table>
### Comments – Conclusions

- **Grammatiko Creek**: In poor condition due to the fact that the river is dried during the summer months due to the abstraction of water for irrigation.

- **Aliakmonas (AL1)**: There is a consensus of all the indices in the status of all three Aliakmonas crossings: moderate to excellent state. Fishes include protected and Balkan endemic fishes.

- **Aliakmonas (AL2)**: There is a consensus of all the indices in the status of all three Aliakmonas crossings: moderate to excellent state. Fishes include protected and Balkan endemic fishes.

- **Aliakmonas (AL3)**: There is a consensus of all the indices in the status of all three Aliakmonas crossings: moderate to excellent state. Fishes include protected and Balkan endemic fishes.

*Compiled by ERM (2013) based on ENT Pipeline Engineering Team inputs*
Box 8-7 presents the key sources of impact, potentially impacted resources and receptors, the baseline conditions and Project factors potentially influencing impacts to freshwater ecology.

Box 8-7    Key Considerations for Assessment – Freshwater Ecology

Sources of Impact /Risk
- Construction Phase: In case of open cut; Trenching in the bottom of the watercourse working strip; Backfilling and reinstatement of the river crossing; Deposition / discharge of waste.
- Operation and Maintenance Phase: Only in the case of pipeline repair works, would there be a possibility that River crossings will need to be opened up again.
- Decommissioning Phase: No impacts are envisaged, since it can be assumed that the pipeline will remain in place at the river crossings.

Potentially Impacted Resources and Receptors
- Freshwater fish fauna

Particular Baseline Conditions that are Potentially Influencing Impacts/Risks
- Impacts associated with the presence and sensitivity of habitats, flora and fauna

Project Factors that are Potentially Influencing Impacts/Risks
- River crossing methods (dry/wet open-cut, trenchless)

References
- Baseline information is found in Section 6.3.2 and 6.3.3.5. Impact Assessment Criteria is found in Annex 5.7. Monitoring Measures are described in Section 9.2.

ERM (2012)

The following table (Table 8-53) presents the key potential impacts of the Project on freshwater ecology factors during the key phases.

Table 8-53    Key Potential Impacts – Freshwater Ecology

<table>
<thead>
<tr>
<th>Impacts and Impact Sources</th>
<th>Construction</th>
<th>Operations &amp; Maintenance</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct loss of species and aquatic habitats from the construction activities in rivers.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporary / permanent habitat loss and degradation of habitat (from increased sediment load and turbidity) from river crossings of pipes.</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Habitat degradation and species loss as a result of accidental pollution release during river crossing.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Indirect impacts from reduced water quality resulting from works outside rivers.</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Changes in hydrology from pipelaying.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbance / displacement of species during the works period process.</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Habitat fragmentation and barrier effects from the construction activity.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Effects on water quality from dewatering of hydrotest water.</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Indirect/induced impacts from improved access.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Source: ERM (2012)
The following sections provide a discussion of how the various sources of impact are likely to have an impact on the receptor and the mitigation measures incorporated within the Project to reduce any negative impacts.

8.8.2 Construction and Pre-commissioning Phase

8.8.2.1 Potential Impacts

8.8.2.1.1 Sediment Entrainment during Open-Cut River Crossings

Stream and river crossings are generally planned to be implemented by open-cut trenching. Details of the method are provided in Project Description (Section 4.4.5).

Watercourse crossing construction can increase downstream total suspended sediment (TSS) through:

- trench excavation (trenching)
- backfilling
- the storage of excavated material directly in the watercourse
- the installation of isolation and diversion structures
- erosion and run-off from adjacent upland worksites
- the discharge of water from hydrostatic pipe testing or trench dewatering
- run-off from nearby construction activities

Sediment entrainment has the potential to negatively affect the river ecosystem in many different ways. For instance this can be by changing the riverbed habitat due to smothering of the gravel beds, by increasing turbidity and therefore reducing light availability in the water, by affecting the invertebrate communities (filtering taxa mainly), by interfering with the fish gills, etc.

In addition, a significant increase of sediment in the water has the potential to be accompanied by a reduction on dissolved oxygen (DO), which can have a negative impact on the river species. It should be noted that different species have different oxygen requirements and therefore while this can have an impact on some species or taxa it can still be negligible to others.
Different types of rivers would have different sensitivities to increased suspended solids depending on the existing background levels. In fact the fauna in the rivers is already an indication on the conditions of water turbidity, quality and water regime. This is because all rivers have adapted to cope with certain pulses of turbidity associated to rains in the catchment areas (this is especially the case in the Mediterranean rivers where relevant changes can occur in short periods of time). Therefore a specific pulse of sediments in a specific river channel may have the potential to raise negative impacts in some rivers that would prove to be negligible in some others.

Crossings will be required along the entire length of the pipe corridor within Greece. In addition, temporary crossings during the construction phase will also be required in order to actually create a proper pipe crossing; here equipment is needed on both sides of a river so a temporary crossing may be needed upstream or downstream of the pipe, and this crossing may be present during the entire build period for the relevant section.

Disturbance will be limited to faunal species comprising largely of fish and vertebrate species utilising riparian habitat such as otters (*Lutra lutra*). Disturbance will occur only during the works period from pipe or road crossings when noise, light, visual and vibration emissions will mean species may temporarily stop utilising the area. This may be of particular importance for fish species trying to access spawning grounds ([i.e. Shad, *Alosa* spp.]) or moving between feeding resources (this is the case for several species of fish present in the region).

Displacement may occur as a long term result of disturbance, but of more importance and likely significance will be the impacts that result from where habitat has become degraded and has lost its ability to support species. Such impacts are likely to result mostly from river crossings. Impacts will generally be short term and evidence from Anderson *et al.* (1998), Blais and Simpson (1997) and Conner *et al.* (1993) shows that this is generally the case for fish species and invertebrates in dynamic river systems. Cumulative impacts on species in sections of the same catchment river should be analysed to evaluate that no negative synergies are generated downstream as these would have the potential to be more long term and this may be particularly the case for Otter and some fishes.

Dry and wet open-cut techniques require direct works within watercourses which will cause direct loss of habitat and species (mostly flora, macroinvertebrates and phytobenthos) within the river
and along the bankside. Impacts of both techniques on bankside vegetation, disturbance and displacement of species, fragmentation and species loss will be similar. However, where the techniques will differ in their impact will be within the river where increased sediment load/turbidity and reduced water quality downstream of the works area may be largely mitigated by employing the Dry open-cut technique. For with the adoption of this technique after the initial dam creation, works within the river will produce minimal levels of sediment and therefore habitat degradation, species loss and secondary impacts on macroinvertebrates and fish will be significantly reduced (Nugent, 2011).

In contrast to the open-cut techniques, trenchless techniques would be likely to have negligible impacts on the aquatic environment (Nugent, 2011) as no direct works would be undertaken within the watercourse. Temporary crossing would be required initially to set up exit and entry portals for the pipe. Such crossings would however be only of low intensity and very temporary. When it is employed this technique does however take substantially longer to complete than open-cut techniques. So the adoption of this trenchless technique in conjunction with the number of crossings will increase the potential for more long-term displacement of species from the works area, such as otters, where the population may be affected by impacts on numerous individual territories. However, as the retention of passage, feeding resource and the presence of long term quality resting sites (in bankside vegetation) are often key limiting factors for this species it is likely that the long term impacts from trenchless techniques will be less than for open cut techniques. In addition, as night works are not foreseen and the otter is a predominantly nocturnal species, disturbance and displacement of the species is expected to be unlikely when trenchless crossing techniques are applied.

Overall, it can be certainly stated that Impacts on the aquatic environment will differ significantly with wet open crossing having the greatest potential negative impact and trenchless techniques having the least impact on the aquatic environment.

Based on the above it can be stated that all water courses crossed by an open cut technique have the potential to be negatively affected by a temporary increase of turbidity and reduction of water quality. Nevertheless, key to this assessment is to consider the sensitivity of the river the effects of the proposed technique. For example this could consider the quality of the aquatic environment and identify to what extent sensitive communities can be negatively impacted during the construction operations by a pulse of turbidity in the case of an open cut technique.
As per the results compiled in Table 8-52 it has been considered that from the 20 rivers considered to have high ecological potential a total of six (6) are actually in poor condition (i.e. as shown by having very poor fish population/species or by the combination of indicators for fishes, macroinvertebrates and diatoms). These include: Fytemata (Mega Rema), Chionorrema (Bosbos), Tafros Belitsa (Mitrousi), Strymonas, Vrardarovasi, Grammatiko Creek. In all these rivers the potential to generate a relevant impact due to an increased turbidity during construction is rather scarce and considered as not significant.

The remaining 16 river crossings are considered to be in good/very good condition or at least to include some fish species of interest or abundant fish populations (that could be the key source to animals such as otters or some species of birds mainly). Among these 16 a total of 8 rivers are considered to be especially relevant thanks to the presence of valuable fish species and populations often in combination with good communities of macroinvertebrates and diatoms. These rivers are: Filiouris (Vathoulorema), Nestos, Tafros Aggitis (Filippoi), Aggitis, Axios, Aliakmonas (crossing AL1), Aliakmonas (crossing AL2), Aliakmonas (crossing AL3).

Of remarkable interest are the three Aliakmonas crossings as they proved to retain very good populations of fishes, the absence of non indigenous fish species and also a healthy population of macroinvertebrates and diatoms, thus demonstrating that the river maintains a good water quality when compared with many of the remaining middle-to large sized rivers located along the entire pipeline corridor.

The potential to create relevant negative impacts in these 16 rivers would be high in the case of a wet open cut technique. However, in all 16 river crossings the project design has defined that only dry open cut or trenchless (e.g. HDD) techniques would be used. With both these latter two techniques the potential for generating relevant pulses of high turbidity are significantly reduced and therefore there is also a reduced risk for a significant impact on the river ecosystem. This is specially the case for those specific rivers in which a trenchless technique is being proposed, which include 10 out of 16 crossings (including the 3 Aliakmonas crossings). Based on this, the impact significance for the crossing of the 16 above-mentioned rivers is moderate and basically it is associated to the risks inherent from any construction operation (e.g. failure of machinery being used in the river, unexpected river conditions, etc.) which are standard and managed through the management plans of the construction site.
8.8.2.1.2 Impacts to Water Quality from Accidental Release of Drilling Mud during Trenchless River Crossing

HDD is a trenchless crossing method which begins with boring a small diameter, horizontal hole (pilot hole) under the river with a continuous string of steel drill rod (refer to Section 4.4.5 Project Description for further details). When the bore head and rod emerge on the opposite side of the crossing, a special cutter, called a back reamer, is attached and pulled back through the pilot hole. The reamer bores out the pilot hole so that the pipe can be pulled through. The pipe is usually pulled through from the side of the crossing opposite the drill rig.

Usually a drilling mud, such as fluid bentonite clay (an inert, non-toxic substance), is forced down the hole to stabilize the hole and remove soil cuttings. Bentonite reduces drilling torque, gives lubrication to the pipe, provides annular flushing of the freshly cut borehole soil debris, and affords stability and support for the bored hole.

There have been very rare instances during HDD construction when bentonite clay has leaked from the horizontal bores and filtered into the watercourse. Although bentonite is inert and non-toxic, the accidental release of a significant quantity could impair water quality and thus have an effect on freshwater ecology. In such unlikely cases the standard construction procedure would be to stop the HDD operations, recover as much bentonite as possible from the bore and leave the filtered bentonite to naturally stabilize. In order to continue, the bore hole would be deviated to a new location, close by but with no unstable terrain, so as to ensure that the water course remains unaffected. In addition, and as a standard prevention measure during the operations, the HDD process is monitored continuously (i.e. GPS device installed on the head of the cutter head) to ensure an early identification of any potential filtrations of bentonite and therefore diminish the likelihood of any significant release.

Based on the non-toxic nature of the bentonite and the unlikely event of an accidental release occurring then the significance of the impact is considered to be not significant.
8.8.2.1.3 Impacts to Water Quality, Fish Eggs and Macroinvertebrates during Hydrotesting

Hydrotesting of pipelines is performed to expose defective materials that have missed prior detection, ensure that any remaining defects are insignificant enough to allow operation at design pressures, expose possible leaks and also serve as a final validation of the integrity of the constructed system. This procedure involves filling the pipeline with water, pressure testing the pipeline to ensure integrity and subsequently discharging the water.

Hydrotesting will require water abstraction from local water sources. The water used will generally be collected and reused in testing subsequent pipeline sections. After its use the water will be discharged to local watercourses. An aspect of hydrotesting is that the volume of water discharged from each section may have physico-chemical impacts on the receiving waters. Abstraction, reuse, monitoring of water quality and eventual discharge of hydrotesting water will be the responsibility of the contractor, who will also undertake to get the required permits from the Administration Authorities (as applicable). Pipelines are sometimes protected from chemical and microbiological damage by the use of oxygen scavengers, corrosion inhibitors or biocides during hydrostatic testing. These may have toxicological impacts on the overall receiving aquatic ecosystem and therefore in case such products are used in testing then a full monitoring of the water will be performed before being discharge into any river course.

Another potential risk is that if water from one specific river catchment is discharged in other river basins a cross “contamination” with alien species can occur (i.e. invasive species of fauna and flora present in one watershed could be transferred to other rivers that to date are free of such invasive species, thus leading to a potential ecosystem degradation).

The abstraction of water from water bodies can also decrease water volume and flow, resulting in a decrease in habitat (e.g. wetted area in a stream or lake); water quality changes (increased temperature and decreased dissolved oxygen [DO]); and entrainment of small fish eggs, and macroinvertebrates during water abstraction. If hydrostatic testing takes place during spring or summer it may affect spawning species through decreases in water levels (displacing spawning habitat) and water quality degradation. Fish eggs could be affected through desiccation if water levels drop however it is unlikely that they would be affected by the pumping itself as in most cases freshwater fish eggs remain attached on the river /lake substrate throughout development. Juvenile fish could however be susceptible to entrainment during water abstraction, survivability
could decrease through reduced water quality habitat and food sources affected through entrainment of macroinvertebrates and there could be a decreased suitability of reproduction areas with lower flows.

In addition, the discharge of large volumes of hydrostatic test waters into surface waters could temporarily cause an increase in downstream flows and cause streambank and substrate erosion.

As per the current project definition, the hydrotest water abstraction and discharge locations will be limited and only surface water sources with larger flows have been considered. Table below gives the potential water sources identified along the TAP route and the volumes required for hydro-testing the pipeline along each of the construction spreads. The timing for the hydrostatic testing activities will consider the seasonal changes of river flows and the reduced flows during the summer months.

The indicative water sources as well as the discharge points and the corresponding water volumes are provided below:

<table>
<thead>
<tr>
<th>Potential water abstraction source</th>
<th>Water volume (approximately m³)</th>
<th>Proposed discharge point</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Evros (KP 0)</td>
<td>58,483</td>
<td>River Evros (KP 0)</td>
</tr>
<tr>
<td>River Filiouris (KP 77.4)</td>
<td>38,769</td>
<td>River Filiouris (KP 77.4)</td>
</tr>
<tr>
<td>Xiropotamos (Kompsatos) (KP 112.6)</td>
<td>25,442</td>
<td>Xiropotamos (Kompsatos) (KP 112.6)</td>
</tr>
<tr>
<td>Kosinthos (Xanthis river) (KP 135.,7)</td>
<td>20,045</td>
<td>Kosinthos (Xanthis river) (KP 135.7)</td>
</tr>
<tr>
<td>Nestos river (KP 153.5)</td>
<td>66,304</td>
<td>Nestos river (KP 153.5)</td>
</tr>
<tr>
<td>Aggitis (KP 229.5)</td>
<td>45,818</td>
<td>Angitis (KP 229.5)</td>
</tr>
<tr>
<td>Strymonas (KP 296.5)</td>
<td>59,917</td>
<td>Strymonas (KP 296.5)</td>
</tr>
<tr>
<td>Parthenorema (KP 377)</td>
<td>12,516</td>
<td>Axios (KP 369,9)</td>
</tr>
<tr>
<td>Parthenorema (KP 377)</td>
<td>41,805</td>
<td>Potamos (KP 414.8)</td>
</tr>
<tr>
<td>Potamos (Channel 66) (KP 414.8)</td>
<td>2,895</td>
<td>Potamos (KP 414.8)</td>
</tr>
<tr>
<td>Potamos (Channel 66) (KP 414.8)</td>
<td>42,912</td>
<td>Ammorycheia (KP 460.1)</td>
</tr>
<tr>
<td>Ammorycheia (KP 460.1)</td>
<td>26,820</td>
<td>Ammorycheia (KP 460.1)</td>
</tr>
<tr>
<td>Aliakmonas (AL 1) (KP 521.3)</td>
<td>35,063</td>
<td>Aliakmonas (KP 521.3)</td>
</tr>
</tbody>
</table>

*Source: ILF (2012) Hydrotest Report Greece (Doc. Ref. GPL00-ILF-100-F-TRS-0001_0D) and ENT (2013) Doc. Ref. GPL00-ENT-100-F-TRS-0001*
According to the current Project design (GPL00-ILF-100-F-TRS-0001_0D--Hydrostatic Testing Concept – Greece and GPL00-ENT-100-F-TRS-0001_00--Hydrostatic Testing Concept – Greece East) the hydrotest concept states that:

- the abstraction rate from the water source will be approximately 300 m³ per hour (300 l/s or 0.3 m³/s); and
- All potential water sources should have a minimum discharge rate of 3 m³/s.
- Monitoring of water quality will be performed before discharge to any river to ensure no risks to the receiving aquatic environment.
- No transfer of water between river watersheds will be carried out to avoid potential transfer of alien/invasive fauna/flora species from different river catchments.

Based on the full implementation of the above standard procedures and hydrotest concept the potential significance of the impact on the rivers derived from the hydrotest is considered to be **Minor**. This is based on the assumption that all sources of water and discharge points will have the above mentioned volumes of water and therefore that hydrotest abstraction and discharge will constitute a small percentage of the rivers flow.

Because of the variable nature of water resources in the Mediterranean rivers (river discharge can vary considerable from one year to another depending on the year’s climatology) it is considered that if such minimum water flow conditions are not met then the significance of the impact could be **moderate to major**, especially for those rivers having sensitive species/aquatic environments or included within any of the various types of protected areas found in the region.

8.8.2.2 Mitigation Measures

8.8.2.2.1 Sediment Entrainment during Open-Cut River Crossings & Trenchless

The following mitigation measures are envisaged in order to reduce or avoid impacts to freshwater ecology due to river crossings:

The crossing of the majority of watercourses will be undertaken by open-cut techniques, for which the following measures will be undertaken:
• Develop a *Watercourse Crossing Plan* for each river crossing to ensure all elements in the river crossing are considered and integrated for each site (i.e. riparian vegetation, presence of sensitive animals such as otters or nesting/breeding grounds, aquatic environment, presence of sensitive species of fishes, etc.) and to evaluate the characteristics and needs of each river crossing;

• Reduce clearance area by using reduced working strip or minimal working strip where riparian forest/sensitive habitats are found;

• Restoration of sites to their original condition, as much as possible, upon completion of construction, especially on the river banks where this will help in reducing risks of erosion and sediment entrainment in the aquatic environment (river banks shall also be stabilized and restored as soon as possible);

• Undertake construction works during low flow conditions or preferably in dry conditions (August – November) for minor crossings;

• River crossing operations shall be planned with the objective of minimizing operations in the rivers. Therefore minimizing the pulse of sediments to the minimum possible;

• The river bed shall be reinstated as much as possible to its original conditions and stabilized to minimize the risk of erosion;

• All relevant rivers that are crossed with open cut (dry or wet) shall be closely monitored before, during and after the operations with the purpose of ensuring no unexpected environmental changes occur down along the river;

• Retain original vegetation where possible for reinstatement;

• Utilisation of sheet pile walls to minimize excavation at river banks;

• Maintain temporary passage across watercourses to ensure unhindered flow of water;

• Utilisation of sediment curtains to prevent dispersion of plume;

• All wastewater to meet the defined standard (e.g. WFD standard), EU and Greek legislation and requirements prior to disposal to a water course;

• Sedimentation pools to be used during construction works;

• Establish a pre- and post- construction biodiversity baseline from which all mitigation, restoration, and loss / degradation can be measured;

• Work to be supervised by an on-site Ecological Clerk of Works (ECoW);

• Maintain passage for fish populations during river works;

• Avoid working at night;
Where amphibian species are present then all possible efforts to remove amphibians should be made, especially those listed in the Bern Convention and 92/43/EEC Habitats Directive;

Any amphibian translocation works should be undertaken post breeding in summer and locations for suitable translocation sites should be made prior to removal (following guidance in the BAP);

Ecological awareness training should be provided to all personnel;

Establishment for a procedure to avoid, monitor and control invasive species if necessary.

Implementation of Pollution Prevention Plan and an Erosion and Sediments Management Plan as is to be included within the ESMP, including, control of river flow, use of booms,

Implementation of Emergency Spill Response Plan;

Mitigation measures will include all those outlined above including both inbuilt and additional measures which will all be listed within the Construction Biodiversity Action Plan;

Where the presence of otters is thought to be likely or has been previously recorded then a pre-construction survey for otters must be carried out and locations of otter resting sites within the works zone are to be recorded so that a detailed works plan can be established to minimize impacts;

Utilise sheet piling, sandbags or ‘aquadams’ to create dry open-cut trench. (earth or other sediment rich material is not recommended);

When creating the dry works corridor, during dewatering any fish or invertebrate species should be carefully removed from this area and replaced within the river in an area with no sediment;

Monitoring of impacts on flora and fauna at sensitive locations;

The footprint of trenchless crossing portals should be kept to an absolute minimum;

Bankside vegetation should be avoided with works undertaken behind this zone;

Plant crossing should be undertaken once or using existing crossing structures;

Use of sediment ponds where run-off occurs;

Implement controls on works areas within the vicinity of watercourses;

Flooding and erosion control measures to be implemented;

Micro-site works as far as possible from watercourses, reservoirs, springs and other water bodies;
• Design of crossings should be made to reduce the requirement for works in the river (use of a single deck spanning the river);

• Retaining sub-surface flows where required for springs or other areas where hydrological function is important;

• Wherever possible vehicles and machinery will avoid contact with surface waters. Portable bridges may be used in order to achieve this. Speeds of vehicles in the pipeline lane will be limited to 20 km/hour. For other access roads, limits will be established in the Traffic Management Plan in agreement with local authorities;

• Access roads located in the proximity of surface water will be paved, or in absence of pavement they will be dampened periodically;

• Trucks transporting construction materials, such as sand, will have covered load containers;

• The use of closed buckets for backhoe dredgers and silt screens;

• Materials will be carefully removed so that they may be reinstated at the same location. If additional reinstatement materials are required, then this will be locally sourced;

• Silt screens must be constructed such that any run off water is retained, settled and filtered. Silt fencing shall be installed on both banks of the watercourse. Silt fencing on the banks around the crossing areas shall be left in place until bank vegetation is established, and their effectiveness will be monitored periodically or after heavy rain periods; and

• Standard sediment control measures will apply to all streams crossed when not dry. Indeed, the empirical rule employed by the US Army Corps of Engineers comprises daily field monitoring of turbidity to maintain increases below 10 Nephelometric Turbidity Units (NTU’s)\(^1\) in any 24-hour period. If increases above this amount are observed, construction is halted until such time as the problem can be resolved. The particular measures will be decided after detailed crossing investigation.

If the HDD crossing technique is found to be technically feasible at any of the river crossings previously indicated, the following measures will be required:

\(^1\)Turbidity can be readily related to the TSS concentration. Nephelometric Turbidity Units (NTUs) is used as a surrogate for Total Suspended Solids (TSS) because it can be measured immediately in the field. A NTU instrument measures the particles of matter that are naturally suspended in water. The NTU /TSS relationship is interpreted by linear regression analysis: the relationship between suspended solids and turbidity is unique to each instrument and each construction site, so instruments must be calibrated prior to field deployment with linear regression analysis.
• The above general principles presented under open-cut shall be applied where it corresponds accordingly (i.e. general preventive and mitigation measures for control of operations and minimization of project footprint);

• Drilling mud, such as bentonite clay, will be an inert and non-toxic substance;

• Muds will be properly managed to avoid discharges to the watercourse; and

• HDD cooling water will be discharged free of any chemicals and with a similar temperature to the water in the watercourse.

8.8.2.2.2 Impacts to Water Quality, Fish Eggs and Macroinvertebrates during Hydrotesting

Key preventive/ mitigation measures for this will be:

• Water taken from one specific watershed and used for hydrotesting shall not be discharged into other watersheds. This is a key point in order to avoid risks of accidental introduction of alien species of fauna and flora to pristine or sensitive rivers (typically this can occur in the form of larvae or seeds).

• No additives such as biocides or oxygen scavengers should be discharged back to the watershed. In case, the use of such additives is necessary the additives will be included in the PLONOR list¹.

• All potential water sources should have a minimum discharge rate of 3 m³/sec in order to be used for hydrotesting.

• The water abstraction from rivers shall be limited to a maximum of 10 % of the run-off rate during the abstraction period.

• Reuse of the hydrotest water will be performed wherever possible to minimize the volumes needed.

• A fine mesh (hole diameter 3 mm) will be applied to water abstraction to avoid entrainment of small fish (note that this will not avoid potential entrainment of small seeds or larvae from all species).

• Water discharge back to rivers / streams will be done through settlement ponds so that any contaminants can settle down prior to discharge and the discharge is also controlled in a way to avoid bank erosion.

¹OSPAR List of Substances Used and Discharged Offshore which Are Considered to Pose Little or No Risk to the Environment (PLONOR)
Water quality will be monitored prior to discharge to comply with local regulations.

Discharges will not be made without prior agreement and appropriate consents and approvals from the authorities.

If feasible, hydrotest water will be reused in subsequent sections of the pipeline, in order to minimise fresh water abstraction needs, although efforts will be made to keep water within the same catchment.

Prior to discharge, water will be tested to ensure that its quality complies with local and international requirements for wastewater discharge. Local treatment (i.e. filtration) will be provided if necessary.

After treatment, discharge of any waters will be carried out so as to minimise physical impacts on receptor morphology, without causing turbulence, using suitably sized pumps.

Development of a Hazardous Materials Management Procedure (see Section 9) in order to detail the procedures for working with chemical products.

8.8.2.3 Residual Impacts

The abovementioned mitigation measures are expected to reduce the significance of impacts to freshwater ecology to acceptable levels. Table 8-55 consolidates potential impacts, mitigation measures and the residual impacts.

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sediment entrainment during open-cut river crossings</td>
<td>Develop a Watercourse Crossing Plan for each river crossing</td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td></td>
<td>Reduce clearance area by using reduced working strip or minimal working strip</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Restoration of sites to their original condition, as much as possible, upon completion of construction.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Undertake construction works during low flow conditions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>River crossings operations shall be planned with the objective of minimizing operations in the rivers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The river bed shall be reinstated as much as possible to its original condition and stabilized to minimize the risk of erosion.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Retain original vegetation where possible for reinstatement.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Utilisation of sheet pile walls to minimize excavation at river banks.</td>
<td></td>
</tr>
</tbody>
</table>

Table 8-55 Residual Impacts – Freshwater Ecology – Construction Phase
### Impact / Risk

<table>
<thead>
<tr>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Maintain temporary passage across watercourses to ensure unhindered flow of water.</td>
<td></td>
</tr>
<tr>
<td>• Utilisation of sediment curtains to prevent dispersion of plume.</td>
<td></td>
</tr>
<tr>
<td>• All wastewater to meet the defined standard (e.g. WFD standard), EU and Greek legislation and requirements prior to disposal to a water course.</td>
<td></td>
</tr>
<tr>
<td>• Sedimentation pools to be used during construction works.</td>
<td></td>
</tr>
<tr>
<td>• Establish a pre- and post-construction biodiversity baseline from which all mitigation, restoration, and loss / degradation can be measured.</td>
<td></td>
</tr>
<tr>
<td>• Work to be supervised by an on-site Ecological Clerk of Works (ECoW).</td>
<td></td>
</tr>
<tr>
<td>• Maintain passage for fish populations during river works.</td>
<td></td>
</tr>
<tr>
<td>• Avoid working at night</td>
<td></td>
</tr>
<tr>
<td>• Where amphibian species present all possible efforts to remove amphibians, appropriately, should be made, especially the Bern Convention and Natura 2000 listed, according to the Biodiversity Action Plan.</td>
<td></td>
</tr>
<tr>
<td>• Ecological awareness training should be provided to all personnel.</td>
<td></td>
</tr>
<tr>
<td>• Establishment for a procedure to avoid, monitor and control invasive species if necessary.</td>
<td></td>
</tr>
<tr>
<td>• Implementation of Pollution Prevention Plan and an Erosion and Sediments Management Plan as it to be included within the ESMP, including, control of river flow, use of booms,</td>
<td></td>
</tr>
<tr>
<td>• Implementation of Emergency Spill Response Plan.</td>
<td></td>
</tr>
<tr>
<td>• Mitigation measures will include all those outlined above including both inbuilt and additional measures which will all be listed within the Construction Biodiversity Action Plan.</td>
<td></td>
</tr>
<tr>
<td>• Where otter presence is thought likely or has been previously recorded pre-construction survey for otters must be carried out and where otter resting sites are recorded within the works zone a detailed works plan should be established to minimize impacts.</td>
<td></td>
</tr>
<tr>
<td>• Utilise sheet piling, sandbags or ‘aquadams’ to create dry open-cut trench. (earth or other sediment rich material is not recommended)</td>
<td></td>
</tr>
<tr>
<td>• When creating the dry works corridor, during dewatering any fish or invertebrate species should be carefully removed from this area and replaced within the river in an area with no sediment.</td>
<td></td>
</tr>
<tr>
<td>• Monitoring of impacts on flora and fauna at sensitive locations</td>
<td></td>
</tr>
<tr>
<td>• The footprint of trenchless crossing portals should be kept to an absolute minimum</td>
<td></td>
</tr>
<tr>
<td>• Bankside vegetation should be avoided with works undertaken behind this zone</td>
<td></td>
</tr>
</tbody>
</table>
### Impact / Risk | Measures to Address the Impact / Risk | Significance of Residual Impact / Risk
--- | --- | ---
- Plant crossing should be undertaken once or using existing crossing structures  
- Use of sediment ponds where run-off occurs.  
- Implement controls on works areas within the vicinity of watercourses.  
- Flooding and erosion control measures to be implemented.  
- Micro-site works as far as possible from watercourses, reservoirs, springs and other water bodies.  
- Design of crossings should be made to reduce the requirement for works in the river (use of a single deck spanning the river).  
- Retaining sub-surface flows where required for springs or other areas where hydrological function is important.  
- Wherever possible vehicles and machinery will avoid contact with surface waters. Portable bridges may be used in order to achieve this. Speeds of vehicles in the pipeline lane will be limited to 20 km/hour. For other access roads, limits will be established at the Traffic Management Plan in agreement with local authorities.  
- Access roads located in the proximity of surface water will be paved, or in absence of pavement they will be dampened periodically; and  
- Trucks transporting construction materials, such as sand, will have covered load containers.  
- Use of closed buckets for backhoe dredgers and silt screens.  
- Materials will be carefully removed so that they may be reinstated at the same location. If additional reinstatement materials are required, this will be locally sourced.  
- Silt screens must be constructed such that any run off water is retained, settled and filtered. Silt fencing shall be installed on both banks of the watercourse. Silt fencing on the banks around the crossing areas shall be left in place until bank vegetation is established, and effectiveness will be monitored periodically or after heavy rain periods.  
- Standard sediment control measures will apply to all streams crossed when not dry. Indeed, the empirical rule employed by the US Army Corps of Engineers comprises daily field monitoring of turbidity to maintain increases below 10 Nephelometric Turbidity Units (NTU's)\(^1\) in any 24-hour period. If increases above this amount are observed, construction is halted until such time as the problem can be resolved. The particular measures will be decided after detailed crossing investigation.

---

\(^1\)Turbidity can be readily related to the TSS concentration. Nephelometric Turbidity Units (NTUs) is used as a surrogate for Total Suspended Solids (TSS) because it can be measured immediately in the field. A NTU instrument measures the particles of matter that are naturally suspended in water. The NTU /TSS relationship is interpreted by linear regression analysis: the relationship between suspended solids and turbidity is unique to each instrument and each construction site, so instruments must be calibrated prior to field deployment with linear regression analysis.
<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling mud, such as bentonite clay, will be an inert and non-toxic substance.</td>
<td>NOT SIGNIFICANT</td>
<td></td>
</tr>
<tr>
<td>Muds will be properly managed to avoid discharges to the watercourse.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD cooling water will be discharged free of any chemicals and with a similar temperature to the water in the watercourse.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water taken from one specific watershed shall not be discharged in other watersheds.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No additives such as biocides or oxygen scavengers should be discharged back to the watershed. In case, the use of such additives is necessary the additives will be included in the PLONOR list.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All potential water sources should have a minimum discharge rate of 3 m³/sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The water abstraction from rivers shall be limited to a maximum of 10 % of the run-off rate during the abstraction period.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reuse of the hydrotest water will be performed wherever possible.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A fine mesh (hole diameter 3 mm) will be applied to water abstraction to avoid entrainment of small fish (note that this will not avoid potential entrainment of small seeds or larvae from all species).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water discharge back to rivers / streams will be done through settlement ponds.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water quality will be monitored prior to discharge to comply with local regulations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharges will not be made without prior agreement and appropriate consents and approvals from the authorities.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If feasible, hydrotest water will be reused in subsequent sections of the pipeline.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior to discharge, water will be tested to ensure that its quality complies with local and international requirements for wastewater discharge. Local treatment (i.e. filtration) will be provided if necessary.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After treatment, discharge of any waters will be carried out so as to minimise physical impacts on receptor morphology, without causing turbulence, using suitably sized pumps.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of a Hazardous Materials Management Procedure (see Section 9.3.8) in order to detail procedures for working with chemical products.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2013)
8.8.3 Operation and Maintenance Phase

No impacts on freshwater ecology parameters are anticipated during the operation and maintenance phases of the pipeline. In case extensive maintenance is required, which would involve taking the pipeline out of the ground, then the associated impacts will be similar to those analysed for pipeline construction.

8.8.4 Decommissioning Phase

Depending on the approach and technologies available at the decommissioning stage, the pipeline may either stay in the ground or will be taken out partly or completely (see Section 4.9 Project Description for further detail). Regarding impacts on freshwater ecology, in the case of taking the pipeline out of the ground then the impacts will be similar to the construction stage and will require diligent care for sediment control.

8.8.5 Summary of Impacts on Freshwater Ecology

River crossings have the potential for disturbing and impacting riverine ecology. Increase of suspended sediment on watercourses during the construction phase is seen as having the greatest potential impact on freshwater ecology, as it can lead to direct fish and macroinvertebrate mortality as well as to medium term disturbance to fauna through modification of the habitats. However, the magnitude of the impact will depend on the riverbed structure, the season of the works, the current status of the river and the crossing technique used during construction. Impacts on flora and fauna will be reduced by using trenchless crossing techniques. Where the use of this technique is not possible due to geotechnical or other technical feasibility constraints then open crossing techniques that minimise sediment dispersion and turbidity plumes in the river flow will be used at periods of the year when river discharge is low. The greater potential impact exists at the three Aliakmonas river crossings due to their excellent conservation status. Where technical considerations do not allow conducting trenchless crossing techniques on those rivers, sediment control measures will be implemented together with a monitoring of fauna populations to ensure that the impact is minimized. Environmental protection
and mitigation measures for each river crossing will be included in the *Water Courses Crossing Plan*.

Water abstraction and subsequent discharge for hydrotesting can lead to the mortality of small fishes, eggs and macro-invertebrates as well as, if undertaken in spring or summer, disturbance to spawning fish species. Furthermore, abstraction during periods of low flow may result in depleted base flows downstream, and conversely water discharges during periods of high flow may result in increased scour, erosion and turbidity. Therefore, abstraction and discharge rates should be established within the naturally occurring range of the average lean and storm water flows. In order to minimise the potential for adverse effects, it is foreseen that water extractions shall only be made from watercourses that have an average flow rate of over 3 m³/s and that maximum abstraction rates shall be agreed with the authorities in charge of the water body in order to avoid water use conflicts or impacts on the riverine ecology. A detailed *Hydrotesting Plan* will be developed by TAP AG based on the *Hydrostatic Testing Concept*. Mitigation such as the use of fine mesh on the abstraction/discharge piping system will help to overcome potential impacts on riverine ecology.

TAP AG will require from the EPC contractor that the Implementation of ecological mitigation measures will be supervised by a team of *Ecological Clerk of Works* (ECoW). No additives will be used; if additives are necessary they will be included in the PLONOR list.

Key impacts on freshwater ecology for the Project will be largely confined to the construction period, with minimal impacts likely to occur during the operation and decommissioning phases of the Project.

### 8.9 Protected Areas / Sites of Conservation Interest

#### 8.9.1 Overview

The pipeline route crosses several areas protected under national legislation. These are grouped into three major categories:
Natura 2000 sites, that also enclose most of the Important Birds Areas (IBAs are not officially protected by national legislation). Natura 2000 sites crossed by the pipeline are the following:

- SPA GR1110009 Notio Dasiko Symplegma Evrou for a length of approximately 13.6 km
- SAC GR1130006 Potamos Filiouris for a length of approximately 0.3 km
- SAC GR1130009 Special Area of Conservation Limnes kai limnothalasses tis Thrakis – Evripter perioxi kai paraktia zoni for a length of approximately 4.3 km
- SPA GR1150001 Special Protected Area Delta Nestou kai limnothalasses Keramotis kai nisos Thasopoula for a length of approximately 4.3 km
- SAC GR1150010 Special Area of Conservation Delta Nestou kai limnothalasses Keramotis – evryteri perioxi kai paraktia zoni for a length of approximately 5.3 km. The crossing of this site partially overlaps with GR1150001 for about 1 km.
- SPA GR1220010 Delta Axiou Loudia Aliakmona Alyki Kitrous for a length of approximately 1.4 km
- SAC GR1220002 Delta Axiou-Loudia-Aliakmona-Evryteri periochi Axioupolis for a length of approximately 1.4 km. The crossing of this site by the pipeline overlaps completely with the crossing of GR1220010.

National Parks. The area crossed by the pipeline along National Parks usually encompasses more than one type of protected areas.

- the National Park of East Macedonia – Thrace for approximately 42.5 km
- the National Park of Koronia – Volvi for approximately 23.2 km

Wildlife Refuge Areas:

- the Wildlife Refuge Kirki for a length of approximately 1.87 km.
- the Wildlife Refuge of Hatisio for approximately 1.4 km.
- the Wildlife Refuge of Kompasatos for approximately 1.4 km.
- the Wildlife Refuge of Kotza Orman Nestou for approximately 3.2 km.
- the Wildlife Refuge of Agios Timotheos – Kioupia for approximately 4.1 km.
- the Wildlife Refuge of Petroto for approximately 3 km.
- the Wildlife Refuge Flamouria – Grammatiko for a length of approximately 5 km.
- the Wildlife Refuge Kouri – Ptolemaida for a length of approximately 8 km.
Table 8-57, Table 8-58 and Table 8-59 briefly describe the Natura 2000 sites, the National Parks and the Wildlife Refuge Areas crossed by the pipeline, respectively. Important Birds Areas and Ramsar sites are incorporated mainly in the Natura 2000 sites and the National Parks. Other protected areas such as the Aesthetic Forest of Kavala are presented in Annex 4.1 – Habitats and Protected Areas Baseline Map.

Box 8-8 presents an overview of the key sources of impact, potentially impacted resources and receptors, and baseline and Project influencing factors associated with this resource.

**Box 8-8  Key Considerations for Assessment – Protected Areas**

**Sources of Impact/Risk**
- Construction Phase: Movement of Vehicles, Equipment, and Personnel; Preparation of the Working Strip (vegetation - topsoil removal); Backfilling and reinstatement of pipeline trench and temporarily disturbed land from construction; River crossings;
- Operation and maintenance phase: Movement of Vehicles, Equipment, and Personnel; Earthworks to reveal the pipeline for maintenance/repair; Maintenance of the 8 m wide protection strip;
- Decommissioning phase: Movement of vehicles, equipment and personnel.

**Potentially Impacted Resources and Receptors**
- Flora, Fauna and habitats.

**Particular Baseline Conditions that are Potentially Influencing Impacts/Risks**
- Quality of habitats;
- Existence of protected species of flora and fauna;
- Land use.

**Project Factors that are Potentially Influencing Impacts/Risks**
- Specific techniques used for crossings (i.e. microtunnelling, open cut river crossings, narrow down the working strip in forest areas);
- Traffic management;
- Construction site and waste management;
- Timing of works.

**References**
- Baseline is found in Section 6.3.4. Impact Assessment Criteria is found in Annex 5.7. Monitoring Measures are described in Section 9.2.

Source: ERM (2012)

Table 8-56 presents the key potential impacts of the Project on protected areas during the key phases.
Table 8-56 Key Potential Impacts – Protected Areas

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Habitat loss as a result of pipeline construction</td>
<td>• Disturbance and/or displacement for species</td>
<td>• Disturbance and/or displacement for species</td>
</tr>
<tr>
<td>• Species loss (injury/mortality of animals) along the working strip</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Disturbance and/or displacement for species</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012)

A brief description of the protected areas crossed by the pipeline is presented in the following tables.
### Table 8-57  Natura 2000 sites crossed by the pipeline

<table>
<thead>
<tr>
<th>CODE</th>
<th>TYPE</th>
<th>OFFICIAL NAME</th>
<th>Description</th>
<th>LENGTH of Pipeline crossing (km)</th>
<th>FROM KP</th>
<th>TO KP</th>
<th>Bundling with the Existing DESFA pipeline (%)</th>
<th>Individual elements of the Project likely to give rise to impacts on the Natura 2000 site</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR1110009</td>
<td>SPA</td>
<td>Notio Dasiko Symplegma Evrou (South Forest Complex Of Evros)</td>
<td>Forests and shrublands where many bird species of conservation interest (esp. Raptors) breed and roost. This site also overlaps with the following sites: Wildlife refuge Kavissos – Pilaia (GG 342/B/1997) Free-range wildlife farm Kirki (GG 1325/15 May 1996) The IBA 005</td>
<td>12.50 1.08</td>
<td>21+400 49+700</td>
<td>33+900 50+800</td>
<td>100% 100%</td>
<td>The construction activities along the working strip within the site, mainly the Loutros forest (KP 29–32) The pipeline bundles 100 % with the existing DESFA pipeline</td>
</tr>
<tr>
<td>GR1130006</td>
<td>SAC</td>
<td>Potamos Filiouris (Filiouris River)</td>
<td>Riparian (and other) habitats of 92/43 EE, reptile, amphibian and mammal species protected under 92/43 EE</td>
<td>0.31</td>
<td>76+400</td>
<td>76+800</td>
<td>100%</td>
<td>The crossing point of river Filiouris.</td>
</tr>
<tr>
<td>GR1130009</td>
<td>SAC</td>
<td>Limnes Kai Limnothalasses Tis Thakis - Evriteri Periochi Kai Parakitia Zoni (Lakes And Lagoons Of Thrace - Broader Area And Coastal Zone)</td>
<td>Large reedbeds all around. Tamarix scrubs, salt marshes, dunes, bordering hills covered by maquis and pseudomaquis and also agricultural lands extending close to wetlands biotopes plain. The site is situated in the East Macedonia – Thrace National Park and also overlaps with WRA Kompsatou and a Ramsar Area.</td>
<td>0.62 3.65</td>
<td>112+600 119+900</td>
<td>113+200 123+500</td>
<td>0 54%</td>
<td>Clearance of the construction zone, trenching, pipe installation and reinstatement. Kompasatos River crossing is planned to be implemented by trenchless method (HDD), which is expected to minimise any impact on riparian galleries or freshwater fauna</td>
</tr>
<tr>
<td>GR1150001</td>
<td>SPA</td>
<td>Delta Nestou kai Limnothalasses Nisos Thasopoula (Delta Of Nestos And Lagoons Of Keramoti And Thasopoula Island)</td>
<td>The SPA consists of a large Delta and almost entirely of agricultural land with few freshwater lagoons separated from the sea by narrow sandy strips. The site is situated in the East Macedonia – Thrace National Park and partially overlaps with WRA Kotza Orman Nestou, a Ramsar Area and with the NATURA 2000 site GR1150010 (see below).</td>
<td>4.27</td>
<td>156+900</td>
<td>161+200</td>
<td>100%</td>
<td>Construction of working strip Nestos River crossing is planned to be implemented by trenchless method (such as HDD), which is expected to minimise any impact on riparian galleries or freshwater fauna</td>
</tr>
<tr>
<td>CODE</td>
<td>TYPE</td>
<td>OFFICIAL NAME</td>
<td>Description</td>
<td>LENGTH of Pipeline crossing (km)</td>
<td>FROM KP</td>
<td>TO KP</td>
<td>Bundling with the Existing DESFA pipeline (%)</td>
<td>Individual elements of the Project likely to give rise to impacts on the Natura 2000 site</td>
</tr>
<tr>
<td>----------</td>
<td>------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------</td>
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<td>----------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>GR1150010</td>
<td>SAC</td>
<td>Delta Nestou kai Limnothalasses Keramoti - Evriti Periosti kai Paraktia Zoni (Delta of Nestos and Lagoons of Keramoti - Broader Area and Coastal Zone)</td>
<td>The SAC consists of Nestos Delta and Keramoti lagoons. River banks are sandy with extended softwood and riparian forests. Moreover, a mosaic of biotopes at the mouth of the river, composed by reedbeds, Tamarix scrubs, inland as well as large coastal dunes is found. The site is situated in the East Macedonia – Thrace National Park, and partially overlaps with WRA Kotza Orman Nestou, a Ramsar Area and with the NATURA 2000 site GR1150001 (see above).</td>
<td>5.31</td>
<td>152+700</td>
<td>158+000</td>
<td>100%</td>
<td>Construction of working strip. River crossing of Nestos is planned to be implemented by a trenchless method (such as HDD), which is expected to minimise any impact on riparian galleries or freshwater fauna</td>
</tr>
<tr>
<td>GR1220002/GR1220010</td>
<td>SPA/ SAC</td>
<td>Delta Axiou,oudia, Aliakmona, Alyki Kitrous (Delta of Axios, Loudias, Aliakmonas Rivers, Salt lake of Kitros) Delta Axiou,oudia, Aliakmona, Eryteri Periosti Axioupolis (Delat of Axios, Loudias, Aliakmonas Rivers – Broader Area of Axioupol)</td>
<td>The site has both SPA and SCI designation. It comprises a coastal wetland of small lagoons, sandflats, and alluvial forests dominated by Tamarix spp, Alnus spp and Salix spp. It is a very important site for breeding, passage and wintering waterbirds. Human activities include rice production, livestock farming, fishing and mussel culture. Both sites completely overlap along the area crossed by the pipeline.</td>
<td>1.40</td>
<td>369+800</td>
<td>371+200</td>
<td>0</td>
<td>The location of the crossing is about 1.2 km to the north of the National Park “Estuaries of Axios-Loudias-Aliakmonas river (Also designated as Ramsar site). River crossing will be implemented by a trenchless method (such as HDD), which is expected to minimise any impact on riparian galleries or freshwater fauna</td>
</tr>
</tbody>
</table>

**TOTAL LENGTH (km) THROUGH NATURE SITES** 29.13 87%

*Source: ASPROFOS (2013), ERM (2012)*
**Table 8-58 National Parks crossed by the pipeline**

<table>
<thead>
<tr>
<th>CODE</th>
<th>ZONE</th>
<th>OFFICIAL NAME</th>
<th>Description</th>
<th>LENGTH (km)</th>
<th>FROM KP</th>
<th>TO KP</th>
<th>Bundling with the Existing DESFA pipeline (%)</th>
<th>Individual elements of the Project likely to give rise to impacts on the National Parks</th>
</tr>
</thead>
<tbody>
<tr>
<td>NP11</td>
<td>A</td>
<td>National Park of Eastern Macedonia – Thrace</td>
<td>It is one of the most important wetland complexes of Greece. It encompasses the NATURA sites GR1150010, GR1150001, GR1130009, GR1130010 and the corresponding Ramsar sites, and the wildlife refuges of Kotza Orman Nestou and Kompsatos River, among others.</td>
<td>0.52</td>
<td>153+400</td>
<td>153+900</td>
<td>100%</td>
<td>Trenchless crossing technique (such as HDD) for the crossing Nestos river from KP 152.5 to 158 will be performed as well as for the Kompsatos River (KP 112.6 to 113.2). This technique is expected to minimise any impact on riparian galleries or freshwater fauna and freshwater ecology</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td></td>
<td></td>
<td>0.40</td>
<td>112+500</td>
<td>112+900</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td></td>
<td></td>
<td>3.40</td>
<td>120+000</td>
<td>123+400</td>
<td>58%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D</td>
<td></td>
<td></td>
<td>0.87</td>
<td>152+500</td>
<td>153+400</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.76</td>
<td>153+900</td>
<td>159+700</td>
<td>93%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.21</td>
<td>111+300</td>
<td>112+500</td>
<td>79%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7.10</td>
<td>112+900</td>
<td>120+000</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.66</td>
<td>123+400</td>
<td>129+000</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.33</td>
<td>151+200</td>
<td>152+500</td>
<td>78%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15.57</td>
<td>159+700</td>
<td>175+300</td>
<td>77%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.71</td>
<td>175+300</td>
<td>176+000</td>
<td>37%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL LENGTH (km) THROUGH NP11</td>
<td>42.53</td>
<td>66%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NP4</td>
<td>C</td>
<td>National Park Of Lakes Koronia - Volvi</td>
<td>Riparian, lacustrine (and other) habitats of 92/43 EE, reptile, amphibian and mammal species protected under 92/43 EE. It also encompasses the Important Bird Area (IBA) GR032.</td>
<td>10.31</td>
<td>312+400</td>
<td>322+700</td>
<td>100%</td>
<td>Construction of working strip</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.25</td>
<td>328+200</td>
<td>329+500</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11.70</td>
<td>332+400</td>
<td>344+100</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL LENGTH (km) THROUGH NP4</td>
<td>23.26</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL LENGTH (km) THROUGH NATIONAL PARKS</td>
<td>65.79</td>
<td>78%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 8-59  Wildlife Refuge Areas crossed by the pipeline

<table>
<thead>
<tr>
<th>OFFICIAL NAME</th>
<th>Description</th>
<th>LENGTH (km)</th>
<th>FROM KP</th>
<th>TO KP</th>
<th>Bundling with the Existing DESFA pipeline (%)</th>
<th>Individual elements of the Project likely to give rise to impacts on the Wildlife Refugee areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periochi Kirkis (Kirki Area)</td>
<td>Main conservation concern of this site are raptor species.</td>
<td>1.18</td>
<td>50+500</td>
<td>51+600</td>
<td>100 %</td>
<td>Construction of working strip</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.69</td>
<td>54+000</td>
<td>54+700</td>
<td>100 %</td>
<td></td>
</tr>
<tr>
<td>TOTAL LENGTH THROUGH PERIOCHI KIRKIS (km)</td>
<td></td>
<td>1.87</td>
<td></td>
<td></td>
<td>100 %</td>
<td></td>
</tr>
<tr>
<td>Hatoisio</td>
<td>The aim of its designation has been to relieve hunting pressure on lowland fauna species.</td>
<td>1.44</td>
<td>98+500</td>
<td>100+000</td>
<td>13 %</td>
<td>Construction of working strip</td>
</tr>
<tr>
<td>Periochi Kompastou (kompastou's area)</td>
<td>The wildlife refuge is part of the National Park of Eastern Macedonia – Thrace and overlaps with GR1130009</td>
<td>1.39</td>
<td>114+400</td>
<td>115+800</td>
<td>0</td>
<td>Construction of working strip</td>
</tr>
<tr>
<td>Kotza Orman Nestou</td>
<td>The wildlife refuge is part of the National Park of Eastern Macedonia – Thrace and overlaps with GR11500001 and GR11500010</td>
<td>3.16</td>
<td>153+100</td>
<td>156+300</td>
<td>100 %</td>
<td>Construction of working strip</td>
</tr>
<tr>
<td>Agios timotheos-kioupia</td>
<td>The aim of its designation has been to relieve hunting pressure on fauna species.</td>
<td>4.15</td>
<td>187+300</td>
<td>191+500</td>
<td>0</td>
<td>Construction of working strip</td>
</tr>
<tr>
<td>Petroto-faraggi-almyra</td>
<td>A complex of arable land interrupted by semi-natural hedges, small patches of woody species, pastures and water ponds.</td>
<td>3.00</td>
<td>225+200</td>
<td>228+200</td>
<td>100 %</td>
<td>Construction of working strip</td>
</tr>
<tr>
<td>Flamouria – grammatiko</td>
<td>The wildlife refuge comprises part of the beech and oak/beech forest of Mt.Vermio and the main aim of its designation has been to relieve hunting pressure on mountainous fauna species.</td>
<td>5.1</td>
<td>433+300</td>
<td>438+400</td>
<td>0</td>
<td>Construction of working strip</td>
</tr>
<tr>
<td>Kouri – Ptolemaida</td>
<td>The wildlife refuge comprises agricultural land and meadows around the town of Ptolemaida and the main aim of its designation has been to relieve hunting pressure on lowland fauna species such as grey partridge (<em>Perdix perdix</em>).</td>
<td>8.00</td>
<td>471+000</td>
<td>479+000</td>
<td>0</td>
<td>Construction of working strip</td>
</tr>
<tr>
<td>TOTAL LENGTH THROUGH WILDLIFE REFUGE AREAS (km)</td>
<td></td>
<td>28.10</td>
<td></td>
<td></td>
<td></td>
<td>29 %</td>
</tr>
</tbody>
</table>

As illustrated in Annex 4.1 – Habitats and Protected Areas Baseline Map and in the following figures (Figure 8-10, Figure 8-11 and Figure 8-12), many of the sites are overlapping. In specific terms, Table 8-60 illustrates the length of the current baseline along overlapping protected areas. Consequently, the actual intervention in protected areas is approximately 390.5 ha. Through all protected areas (i.e. regardless of any overlapping or not) the TAP alignment is bundling for approximately 69% of the route with the existing DESFA pipeline.

Table 8-60 Overlapping of protected areas

<table>
<thead>
<tr>
<th>From KP</th>
<th>To KP</th>
<th>Overlapping Length (m)</th>
<th>Overlapping Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>50+500</td>
<td>60+000</td>
<td>375</td>
<td>GR1110009</td>
</tr>
<tr>
<td>112+600</td>
<td>113+200</td>
<td>623</td>
<td>WRA of Kirki</td>
</tr>
<tr>
<td>114+400</td>
<td>115+800</td>
<td>1,389</td>
<td>National Park of Eastern Macedonia - Thrace</td>
</tr>
<tr>
<td>120+000</td>
<td>123+500</td>
<td>3,650</td>
<td>WRA Periochi Kompsatou</td>
</tr>
<tr>
<td>152+700</td>
<td>153+100</td>
<td>433</td>
<td>National Park of Eastern Macedonia - Thrace</td>
</tr>
<tr>
<td>153+100</td>
<td>156+300</td>
<td>3,160</td>
<td>GR1150010</td>
</tr>
<tr>
<td>156+300</td>
<td>157+000</td>
<td>681</td>
<td>WRA Kotza Orman Nestou</td>
</tr>
<tr>
<td>157+000</td>
<td>158+000</td>
<td>1,034</td>
<td>National Park of Eastern Macedonia - Thrace</td>
</tr>
<tr>
<td>158+000</td>
<td>161+200</td>
<td>3,230</td>
<td>GR1150001</td>
</tr>
</tbody>
</table>

**Total** 14,575

Source: ASPROFOS (2013)
Figure 8-10 Overlapping protected areas of GR1110009 and WRA of Kikri and bundling with DESFA pipeline

Legend
- PIPELINE ROUTE
  - TAP GREECE - BASE CASE
  - EXISTING PIPELINE OF DESFA
- PROTECTED AREAS
  - WILD LIFE REFUGE
  - NATURA 2000
- BOUNDARIES
  - MUNICIPALITIES
  - NATIONAL

Source: ASPROFOS (2013)
Figure 8-11   Overlapping of protected areas and bundling with DESFA pipeline within the National Park of Eastern Macedonia – Thrace

Legend
- PIPELINE ROUTE
  - TAP GREECE BASE CASE
  - EXISTING PIPELINE OF DESFA
- PROTECTED AREAS
  - WILDLIFE REFUGE
  - NATURA 2000
  - NATIONAL PARK
- BOUNDARIES
  - MUNICIPALITIES

Source: ASPROFOS (2013)
Figure 8-12  Bundling through the National Park of Lakes Koronia and Volvi

Legend

**PIPELINE ROUTE**
- TAP GREECE- BASE CASE
- EXISTING PIPELINE OF DESFA

**PROTECTED AREAS**
- NATIONAL PARKS
- NATURA 2000

**BOUNDARIES**
- NATIONAL PARK OF KORONIA & VOLVI

Source: ASPROFOS (2013)
8.9.2 Natura 2000 sites

Potentially affected Natura 2000 sites have been considered in detail through the implementation and results of Appropriate Assessments. The screening process to determine the Natura 2000 sites that might be affected by the project is presented in Annex 8.6. In the appropriate assessment realized for each site, discussion on the impacts and the mitigation measures to be applied are presented. Only a short description is presented in the following:

SPA GR 1110009 – Notio Dasiko Symplegma Evrou (South Forest Complex of Evros)

According to the Appropriate Assessment for SPA GR 1110009 – Notio Dasiko Symplegma Evrou (South Forest Complex of Evros) (see Annex 8.7) there are no impacts anticipated in rare or Annex I Habitat Types within the boundaries of the site. After the implementation of a Restoration Plan, the working strip will be reinstated to its pre-construction condition (as technically feasible) with the exception of the 8 meters wide pipeline protection strip (PPS), where only the agricultural land and open habitats (i.e. absence of deep-rooting species) will be restored to its full extent. As a result, there will be no alteration in the character of the habitat in the area which is important as the qualifying features of the site.

As far as it concerns the qualifying species, both the project design and the implementation of mitigation measures will result in avoiding and minimizing any significant loss of areas of key habitats or any significant increase of fragmentation. Also all these effects will be limited to the duration of the construction works. Any interference with species of conservational interest or unfavourable conservation status on the site will be equally minimized, especially by avoiding bird’s breeding period to the extent that is possible and by micro-siting of the route to avoid nesting trees. Due to the temporary and short term nature of the construction activities, the underground presence of the pipeline during operation, the limited and restricted area of crossing the site, the bundling with the existing DESFA pipeline, as well as the distance from known breeding and wintering sites at the Loutros forest, and the strong mitigation measures to be applied, it is expected that there will be no interference with the balance, distribution and density of key species, or a reduction of either species population or population of international conservational interest. Therefore, a not significant adverse impact is anticipated in the integrity of the SPA site as a result of the construction and operation of the TAP project. More details are presented in Annex 8.7.
SAC GR 1130006 – Potamos Filiouris (River Filiouris)

According to the Habitats Directive Appropriate Assessment performed for the site SAC GR 1130006 - Potamos Filiouris (River Filiouris) (see Annex 8.8), there are no significant impacts anticipated for rare or Annex I Habitat Types. The current project design avoids any intervention within the boundaries of the protected site as the river will be crossed by trenchless techniques, and the construction areas (rig site and pipe receiving site) will be located outside of the boundaries of the protected site in agricultural land. As a result, there will be no alteration in the character of the habitat in the area (riparian habitat and the riverbed) which is important as qualifying features of the site.

As far as it concerns species, then through Project design (trenchless crossing) and the implementation of mitigation measures, any disturbance to species will be minimised and no habitat fragmentation is expected. The absence of night works and the avoidance of interference to the extent that is possible in the bird breeding season will contribute to the normal development of bird and otter populations. The absence of any intervention on the riverbed will avoid impacting on the fish and herpetofaunal species of concern.

Hydrotesting water abstraction and discharge from and into the river will be governed by specific measures, in order to ensure there is no impact on the water regime of the Filiouris River (i.e. ensuring proper flow conditions at the time of water abstraction and careful discharge of the previously treated water (see also Section 8.8.2).

No interference with the balance, distribution and density of key species or any reduction of species population or population of international conservational interest is expected due to:

- the temporary and short-term nature of the construction activities;
- the non-intrusive nature of the pipeline during operation (i.e. trenchless crossing);
- the limited and restricted area crossing the site; and
- mitigation measures to be applied, such as trenchless crossing (e.g. HDD) of the Filiouris River and management of hydrotesting abstraction and discharge of water.
Therefore adverse residual impacts on species, that would compromise the integrity of the Natura 2000 site, as a result of the construction and operation of the TAP Project are anticipated to be **not significant**. More details are presented in **Annex 8.8**.

For SAC GR 1130009 *Lakes And Lagoons Of Thrace - Broader Area And Coastal Zone* no impacts are anticipated in Annex I Habitat Types. After the implementation of the restoration plans, the agricultural land and open habitat will be reinstated to their pre-construction conditions. Development of shallow-rooting crops and vegetation will be allowed along the PPS. As a result, there will be no significant alteration to the character of the habitats in the area. As far as it concerns species, through Project design and the implementation of mitigation measures any loss of significant areas of key habitats or any significant increase in habitat fragmentation will be avoided or minimised. Any interference with species of conservational interest on the site will be equally minimised, especially through the avoidance of construction activity during the bird breeding season to the extent that is possible and by the implementation of a trenchless technique (such as HDD) for crossing the River Kompasatos.

As seen in **Figure 8-13**, the pipeline will go underground from the pipeline site (KP 112.6) located on agricultural land outside the borders of the protected area (right side of the figure) and after an approximate 460 metres underground crossing it will emerge again within the receiving rig side which is again on agricultural land on the west side of the river bed (KP 113.2).

The most fragile habitat in the broader area is the priority habitat 3170 – Mediterranean temporary ponds. This has been identified as being at more than 100 meters from the pipeline route during the field surveys of spring 2013, and therefore is considered as not being affected by the activities.

Hydrotesting water abstraction and discharged from and into the river will be governed by specific measures in order to ensure there is no impact on the water regime of the Kompasatos River (i.e. ensuring proper flow conditions at the time of water abstraction and careful discharge of the treated (if treatment is needed) water) (see also **Section 8.8.2**).
No interference with the balance, distribution and density of key species or any reduction of species population or population of international conservational interest is expected to occur due to:

- the temporary and short-term nature of the construction activities;
- the non-intrusive nature of the pipeline during operation (i.e. underground);
- the limited and restricted area crossing the site;
- the remoteness from known bird breeding and wintering areas in the southern part of the Natura 2000 site; and
- the mitigation measures to be applied, including a trenchless crossing technique, the measures for hydrotesting water management, and pre-construction monitoring.

Therefore, the adverse residual impacts on species that would compromise the integrity of the Natura 2000 site as a result of the construction and operation of the TAP Project. are anticipated to be **not significant**. More details are presented in *Annex 8.9*. 
Figure 8-13  Crossing of Kompatsos River by trenchless crossing method

SPA GR1150001 - Delta Nestou kai Limnothalasses Keramotis kai Nisos Thasopoula (Delta of Nestos and Lagoons of Keramoti And Thasopoula Island) & SAC GR1150010 Delta Nestou kai Limnothalasses Keramotis - Evriteri Periochi kai Paraktia Zoni (Delta of Nestos and Lagoons of Keramoti - Broader Area and Coastal Zone)

For SPA GR1150001 and SAC GR1150010 one integrated appropriate assessment has been prepared. There are two reasons behind this approach: (i) the two areas are overlapping for some part of the area crossed by the pipeline, but most importantly (ii) the two areas are part of the same ecosystem.

No impacts are anticipated for Annex I Habitat Types in either of these two Natura 2000 sites because the crossing of Nestos river will be performed by a trenchless methodology, thus allowing the Project to avoid any impact on the riverbed and its habitats as well as on the riparian habitats. After the implementation of the restoration plans, the agricultural area and open habitat will be reinstated to their pre-construction conditions. Development of shallow-rooting crops or vegetation will be allowed. As a result, there will be no significant alteration to the character of the habitats in the area. As far as it concerns species, through Project design and the implementation of mitigation measures any loss of significant areas of key habitats or any significant increase in habitat fragmentation will be avoided or minimised. Any interference with species of conservational interest on the site will be equally minimised, especially through the avoidance of construction activity during the bird breeding season to the extent that is possible and by the implementation of the trenchless crossing method (e.g. HDD) for crossing the river Nestos.

As seen in Figure 8-14 the pipeline will go underground from the pipe site (KP 153.3) located within the boundaries of the SAC (right side of the figure)and will emerge again within the boundaries of the Natura 2000 site at the receiving side west of the river bed (KP 154) after an approximate 765 meters underground trenchless crossing. On both sides, temporary facilities are located over agricultural areas and thus avoid the riparian habitats.

Potential impacts on the protected area from the Project will be associated with the construction of the working areas for the trenchless crossing (such as HDD) (i.e. 27,618 m²) and the working strip for the trenched section along the western crossing of the TAP through the SAC and SPA. The total area affected within the Natura 2000 sites is approximately 33.5 ha. However, this area is located on land currently used for agriculture.
Hydrotesting water abstraction and discharged from and into the river will be governed by specific measures, in order to ensure there is no impact on the water regime of the Nestos River (i.e. ensuring proper flow conditions at the time of water abstraction and careful discharge of the treated (if treatment is needed) water) (see also Section 8.8.2).

Figure 8-14 Crossing of Nestos River by trenchless crossing method

Source: ENT (2013), APROFOS (2013)
As revealed during the field surveys, there is a risk of disturbance and degradation of important jackal (*Canis aureus*) habitats due to the project’s construction and therefore certain mitigation measures shall be implemented.

Despite potential minor residual impacts on species, these remain at an individual level. No interference with the balance, distribution and density of key species or any reduction of species population or population of international conservational interest is expected due to:

- the temporary and short-term nature of the construction activities;
- the non-intrusive nature of the pipeline during operation (i.e. underground);
- the limited and restricted area crossing the site;
- the remoteness from known bird breeding and wintering areas in the southern part of the Natura site; and
- the mitigation measures to be applied, including proper seasonal restrictions, implementation of the trenchless crossing technique, such as HDD, and management of hydrotesting water.

Therefore, the adverse residual impacts on species that would compromise the integrity of the Natura 2000 sites, as a result of the construction and operation of the TAP Project, are anticipated to be **not significant** to minor. More details are presented in *Annex 8.10*.


For SPA GR1220010 and SAC GR1220002 one integrated appropriate assessment has been prepared. There are two reasons behind this approach: (i) the two areas are completely overlapping on the area crossed by the pipeline, but most importantly (ii) the two areas are part of the same ecosystem.

As presented in the appropriate assessment (*Annex 8.11*) the selection of a trenchless method (such as HDD) for the crossing of the Axios River involves the least possible impacts to the terrestrial habitats, the river beds and the river itself from the pipeline construction.
As can be seen from Figure 8-15, the pipeline will go underground from the rig side located on agricultural land outside the borders of the protected area41 (right side of the figure) and will emerge again at the receiving side approximately 900 meters to the west after the river bed. Then, after a small trenched section of 400 meters in agricultural land within the protected area, the pipeline will go underground again to avoid impacting on the sensitive vegetated area at the border of the protected area. The pipeline will emerge again outside (to the west) of the protected area in agricultural land.

Figure 8-15  Crossing of Axios River by trenchless crossing method

As a result, potential impacts of the Project on the protected area are related to the construction of the working areas for the two trenchless crossings (i.e. the receiving side of the first HDD crossing with an area of 80 x 80 m and the rig side for the second HDD crossing with an area 50 x 30 m) and the trenched pipeline section between the two HDD crossings. All of them are installed on agricultural land. The total area affected within the protected area is 2.3 ha.

41 An extensive and dense riparian forest, largely dominated by Populus alba and including a stand of Fraxinus angustifolia, is present on the eastern side of the river. The sensitive siting of the HDD rig site outside of the protected area will avoid this habitat.
Hydrotesting water abstraction and discharged from and to the river will be governed by specific measures, in order to ensure that there is no impact on the water regime of the Axios River (i.e. ensuring proper flow conditions at the time of water abstraction and careful discharge of the treated (if treatment is needed) water) (see also Section 8.8.2).

Therefore adverse residual impacts on species that would compromise the integrity of the Natura 2000 sites, as a result of the construction and operation of the TAP Project, are anticipated to be not significant.

More details are presented in Annex 8.11.

In the following sections potential impacts to National Parks and Wildlife Refuge Areas are discussed giving information on how the Project is likely to have an impact on the receptors and also about the mitigation measures embedded either within the Project design or considered as a result of this study.

8.9.3 Construction and Pre-commissioning Phase

Potential impacts on Natura 2000 sites were described briefly in the previous section (8.9.2) and are detailed in the Appropriate Assessments for each site. This section presents potential impacts on the National Parks and the Wildlife Refuge Areas crossed by the pipeline.

8.9.3.1 Potential Impacts

8.9.3.1.1 Habitat Loss

National Park of East Macedonia and Thrace Mediterranean

Within the National Park of East Macedonia and Thrace Mediterranean temporary ponds (3170), a 92/43/EEC priority habitat type, have been reported in small patches and stagnant waters with low water depths. The habitat type was mentioned for the area of Nestos river but was not ground thruthed during the fieldwork carried out in the present study. The habitat was recorded, however, in the area of Kompsatos river as being in very small stands (of 1 - 2 m²) at a distance of approximately 100 meters from the proposed pipeline route.
Within the National Park of eastern Macedonia – Thrace the following European Habitats can be found along the proposed working strip:

- 1.14 ha of European Habitat 3280 Constantly flowing Mediterranean rivers with Paspalo-agrostidion species and hanging curtains of *Salix* and *Populus alba*
- 2.18 ha of European Habitat 92A0 *Salix alba* and *Populus alba* galleries

Despite being recorded along the pipeline route, these two European Habitats will be completely avoided by the project because of the use of a trenchless methodology for the crossing of Kompasatos and Nestos rivers where they are located.

The rest of the habitats are illustrated in the following table (*Table 8-61*). The habitats lying within the Wildlife Refuge Areas of Kotza Orman Nestou and of Periochi Kompsatou are included in the following table for the National Park of Eastern Macedonia – Thrace, since they totally overlap, at least for the section that will be occupied by the 38 meters wide working strip.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Total habitat in the 500 m study area (ha)</th>
<th>Total habitat in the 38 m working strip (ha)</th>
<th>% of the 38 m working strip occupied by this habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1020</td>
<td>AGRICULTURAL LAND</td>
<td>1,807.01</td>
<td>143.94</td>
<td>90.65</td>
</tr>
<tr>
<td>1030</td>
<td>REFORESTATION</td>
<td>1.86</td>
<td>0.11</td>
<td>0.07</td>
</tr>
<tr>
<td>1050</td>
<td>URBAN SETTLEMENT</td>
<td>15.18</td>
<td>0.22</td>
<td>0.14</td>
</tr>
<tr>
<td>1061</td>
<td>UNVEGETATED SAND BEDS</td>
<td>5.55</td>
<td>0.41</td>
<td>0.26</td>
</tr>
<tr>
<td>3170</td>
<td>MEDITERRANEAN TEMPORARY PONDS</td>
<td>0.02</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>3280</td>
<td>CONSTANTLY FLOWING MEDITERRANEAN RIVERS WITH PASPA LO-AGROSTIDION</td>
<td>20.27</td>
<td>1.14</td>
<td>0.72</td>
</tr>
<tr>
<td>5160</td>
<td>SOUTH-EASTERN SUB-MEDITERRANEAN DECIDUOUS THICKETS</td>
<td>56.55</td>
<td>4.19</td>
<td>2.64</td>
</tr>
<tr>
<td>5350</td>
<td>PSEUDOMAQUIS</td>
<td>1.62</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>6290</td>
<td>MEDITERRANEAN SUBNITROPHILOUS GRASSLANDS</td>
<td>2.65</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>6420</td>
<td>MEDITERRANEAN TALL HUMID HERB GRASSLANDS</td>
<td>12.27</td>
<td>1.46</td>
<td>0.92</td>
</tr>
<tr>
<td>6450</td>
<td>GREEK HYPER-MEDITERRANEAN HUMID GRASSLANDS</td>
<td>30.50</td>
<td>2.47</td>
<td>1.55</td>
</tr>
<tr>
<td>32B0</td>
<td>ANNUAL RIVER COMMUNITIES</td>
<td>6.28</td>
<td>0.29</td>
<td>0.18</td>
</tr>
<tr>
<td>62A0</td>
<td>EASTERN SUB-MEDITERRANEAN DRY GRASSLANDS</td>
<td>0.32</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
The agricultural land constitutes approximately 91% of the total occupation within the 38 meters wide working strip. Also, as described in Table 8-58 and Section 6, TAP crosses the National Park mostly through its peripheral zone bundling with the existing DESFA pipeline for approximately 65% of its length through the protected area. This means that any new habitat loss that will be caused will be limited. The magnitude of the impact could be deemed as small, since the availability of the ecological important habitats, within the 500 meters study area is not really affected. Given that most of the land cover occupied by the regular working strip is agricultural land, the sensitivity of the receptor is low and consequently the impacts are assessed as minor, if any, with respect to habitat loss within the National Park of Eastern Macedonia – Thrace, assuming that no mitigation measures are applied.

National Park of Lakes Koronia - Volvi

The study area within the National Park of Lakes Koronia – Volvi, does not host any priority European habitat. Forested habitats include oak forests and riparian galleries of poplars and willows, occupying 2.9% and 0.3% of the 38 meters wide working strip, respectively. As was the case for the National Park of Eastern Macedonia and Thrace, agricultural land constitutes most of the regular working strip, reaching a total of 78%. Grasslands occupy a noticeable percentage (15% in total). As described in Table 8-58 and Section 6, TAP crosses the National Park entirely through its peripheral zone. On top of that, TAP is also bundling with the existing DESFA pipeline for its entire length within the boundaries of the protected area. The magnitude of the impact is considered to be small, when compared to the availability of the ecological important habitats. Given that most of the land cover occupied by the regular working strip is agricultural land then no sensitive habitats exist along the working strip and with the exception of deep-rooting species along the pipeline protection strip the habitats will be reinstated to their pre-construction state. The impact is therefore considered as to be not significant, even when assuming that no mitigation measures have been applied.
The habitats that are going to be impacted are illustrated in the following table (Table 8-61).

**Table 8-62  Land cover occupation by the 38 m working strip within the National Park of Lakes Koronia - Volvi**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Total habitat in the 500 m study area (ha)</th>
<th>Total habitat within the 38 m working strip (ha)</th>
<th>% of the 38 m working strip occupied by this habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1020</td>
<td>ARABLE LAND</td>
<td>842.95</td>
<td>69.01</td>
<td>78.12</td>
</tr>
<tr>
<td>1030</td>
<td>REFORESTATION</td>
<td>0.35</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>1050</td>
<td>URBAN SETTLEMENT</td>
<td>28.53</td>
<td>0.20</td>
<td>0.23</td>
</tr>
<tr>
<td>3190</td>
<td>LAKES OF GYPSUM KARST</td>
<td>0.34</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>5160</td>
<td>SOUTH-EASTERN SUB-MEDITERRANEAN DECIDUOUS THICKETS</td>
<td>96.69</td>
<td>3.10</td>
<td>3.51</td>
</tr>
<tr>
<td>6290</td>
<td>MEDITERRANEAN SUBNITROPHILOS SUB-MEDITERRANEAN DRY GRASSLANDS</td>
<td>66.19</td>
<td>6.53</td>
<td>7.39</td>
</tr>
<tr>
<td>62A0</td>
<td>EASTERN SUB-MEDITERRANEAN DRY GRASSLANDS</td>
<td>75.97</td>
<td>6.64</td>
<td>7.51</td>
</tr>
<tr>
<td>924A</td>
<td>BALKANO-ANATOLIAN THERMOPHILOS [QUERCUS] FORESTS</td>
<td>38.61</td>
<td>2.56</td>
<td>2.90</td>
</tr>
<tr>
<td>92A0</td>
<td>SALIX ALBA AND POPULUS ALBA GALLERIES</td>
<td>7.05</td>
<td>0.30</td>
<td>0.33</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1,156.68</td>
<td>88.34</td>
<td>100.00</td>
</tr>
</tbody>
</table>

*Source: ASPROFOS (2013)*

**Wildlife Refuge of Kirki**

Within the Wildlife Refuge of Kirki, the vegetation clearance and topsoil removal, assuming the maximum working strip is 38 meters, is estimated to result in a loss of:

- 7.3 ha of the European Habitat 9540 (*Mediterranean Pine Forests With Endemic Mesogean Pines*)
- 0.22 ha of the Greek Habitat 924A (*Thermophilous oak woods of E. Mediterranean and Balkans*)

None of these are considered priority habitats. Impact sensitivity is considered moderate, mainly due to the proximity to the protected Natura 2000 site GR1110009 and because of the overall good quality forest habitat in the broader area. As illustrated in Table 8-59, TAP bundles 100 % with the existing DESFA pipeline along this section, where the existing protection strip also contributes to reduce the effect on the forest habitats identified. Consequently, the magnitude of
impact is low. Assuming that no mitigation measures have been applied, the impact significance is considered to be minor.

Wildlife Refuge of Hatisio
Within the “Hatisio” Wildlife Refuge, the vegetation clearance and topsoil removal, based on the habitat identification made during the field survey in September 2012 and May 2013, and assuming that the maximum working strip of 38 meters will be applied, is estimated to result in a loss of:

- 5.6 ha of agricultural land and
- 0.17 ha of European Habitat 92A0 (Salix Alba and Populus Alba Galleries);

The riparian area that is expected to be affected currently presents a degraded status as verified during the field survey, being adjacent to the crossing point of the existing DESFA pipeline where no trees are allowed to grow, and close to the Egnatia Highway. Impact sensitivity is considered to be low. The magnitude of impact is low because the affected area comprises an insignificant percentage of the total area of the refuge. Assuming that no mitigation measures have been applied, impact significance is considered to be not significant.

Wildlife Refuge of Agios Timotheos - Kioupia
Within the wildlife refuge area of Agios Timotheos - Kioupia, the vegetation clearance and topsoil removal will result in an estimated loss of habitats as tabulated in Table 8-63. As illustrated, almost 62% of the Greek Habitat Pseudomaquis will have to be cleared. Pseudomaquis is widely spread all over the mainland of Greece and is of small sensitivity. Most of the typical species (such as Quercus coccifera) of this habitat are known for their resilience to heavy impact and ability of stumps germination. Nevertheless, the magnitude of the impact is deemed to be moderate. Given that the broader area is of high quality, and assuming that no mitigation measures are applied, the impact significance is moderate to minor.
Table 8-63  
Land cover occupation by the 38 m working strip within the Wildlife Refuge of Agios Timotheos - Kioupia

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Total habitat in the 500 m study area (ha)</th>
<th>Total habitat within the 38 m working strip (ha)</th>
<th>% of the 38 m working strip occupied by this habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1020</td>
<td>CULTIVATIONS</td>
<td>11.69</td>
<td>1.65</td>
<td>10.47</td>
</tr>
<tr>
<td>5350</td>
<td>PSEUDOMAQUIS</td>
<td>141.31</td>
<td>9.89</td>
<td>62.82</td>
</tr>
<tr>
<td>6290</td>
<td>MEDITERRANEAN SUBNITROPHILOUS GRASSLANDS</td>
<td>32.66</td>
<td>2.91</td>
<td>18.50</td>
</tr>
<tr>
<td>62A0</td>
<td>EASTERN SUB-MEDITERRANEAN DRY GRASSLANDS</td>
<td>6.92</td>
<td>0.49</td>
<td>3.10</td>
</tr>
<tr>
<td>925A</td>
<td>QUERCUS TROJANA WOODS</td>
<td>7.44</td>
<td>0.81</td>
<td>5.13</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>200.01</td>
<td>15.74</td>
<td>100.02</td>
</tr>
</tbody>
</table>

Source: APROFOS (2013)

Wildlife Refuge of Petroto – Faraggi - Almyra

Within the Wildlife Refuge of Petroto- Faraggi - Almira, the vegetation clearance and topsoil removal, based on the habitat identification made during the field survey in September 2012 and May 2013, and assuming the maximum working strip of 38 meters is estimated not to result in any loss of ecological sensitive habitats. The Greek Habitat Eastern Sub-Mediterranean Dry Grasslands (64A0) is the only ecological sensitive habitat. The regular working strip will result in a loss of approximately 1 ha. Almost the entire 38 meters working strip is occupied by agricultural lands. On top of that, the pipeline is also bundling for its entire length through the protected area with the existing DESFA pipeline (see Table 8-59). The magnitude and sensitivity of impact is small. The impact significance is assessed as being **not significant**.

Wildlife Refuge of Flamouria - Grammatiko

Within the “Flamouria - Grammatiko” wildlife refuge, the vegetation clearance and topsoil removal, based on the habitat identification made during the field survey in June 2011, and assuming the maximum working strip to be 38 meters, is estimated to result in a loss of:

- 15.05 ha of European Habitat 9130 (*Asperulo-fagetum* beech forests);
- 0.78 ha of European Habitat 924A (Thermopihillus oak woods of E. Mediterranean and Balkans);
- 2.93 ha of European Habitat 6420 (Mediterranean tall humid herb grasslands of the *Molinio-Holoschoenion*).
None of these are considered to be priority habitats, with the exception of the beech forest which is relatively rare and has a rich understorey with many orchid species (see Section 6.3.4). Impact sensitivity is considered to be low to medium. The magnitude of impact is low as the affected area comprises approximately 0.9% of the area of the reserve. Assuming that no mitigation measures have been applied, the impact significance is considered to be minor to moderate.

Wildlife Refuge of Kouri
Within the “Kouri” wildlife refuge, the vegetation and topsoil removal processes are estimated to affect mainly agricultural land. The sensitivity of the affected area is low while the magnitude of the impact is also low as the affected area comprises 0.7% of the reserve. The impact significance is considered to be minor, assuming that no mitigation measures are applied.

No upgrading or construction of new roads is planned within any of the protected areas.

8.9.3.1.2 Species Loss (Injury / Mortality of Animals)

In the case of all protected areas, operation of machinery, heavy equipment and supporting vehicles and the presence of people during construction will be a source of noise, light and visual impact. Where present, mammals like Canis aureus or Lutra lutra are expected to move away from the working area; while others like the European ground squirrel (Spermophilus citellus) could experience loss of individuals if a colony is located in the vicinity of the construction area. Loss of flora species could also be caused by direct physical impact through vegetation clearance and soil stripping.

With regard to loss of species, then extensive discussion was presented in the relevant sections of 8.7.2 and is not repeated here. Specifically for the Natura 2000 sites, reference is made to the Appropriate Assessments undertaken for each site.
8.9.3.1.3 Disturbance – Displacement of Species

As previously stated, extensive discussion has been performed in previous sections of the present study (see Section 8.7.2). The following is a short summary which is deemed to be appropriate in order to highlight the potential impacts on the species of interest.

Within the National Park of East Macedonia and Thrace a species that could potentially be affected by the project is the Golden Jackal (*Canis aureus*) which is listed in the SDFs as a species of importance for the sites, and as demonstrated by the literature, the wider area of Nestos and Vistonida supports the largest, healthiest and most dynamic population of the species in Greece. For bird species within the National Park there is a potential impact during the construction phase in terms of loss of their breeding, roosting and foraging habitat. However this is highly unlikely to occur because of the limited duration of the construction works - especially if activities take place outside the breeding period as this would help avoid any potential impact on breeding success. However, from KP 112.5 to 113, where three bird species of high importance were recorded (i.e. Roller *Coracias garrulus*, a Sand Martin’s colony (*Riparia riparia*) and Bee Eater *Merops apiaster*), then the project activities can be performed with certain limitations. Former colonies (and nests in the case of the Roller) of these species were found at 100 meters north from the pipeline. In the case of the sand martin it is considered possible that the site of the colony would be reused due to a lack of suitable nesting sites (i.e. sand banks along the river), and this site would then be potentially impacted. In the case of the roller, the species is adapted to the presence of humans and a certain degree of disturbance, and thus it is considered not to be affected provided that the nesting site remains at a certain distance from the working strip. Assuming that no mitigation measures are applied then the impact significance is expected to be moderate to minor.

Within the National Park of East Macedonia and Thrace from KP 159.5 to 159.8 the pipeline route passes at a close distance from an inland lake where several protected species might nest and could thus be affected during the construction period. Among these species the most important is considered to be the Moustached Warbler (*Acrocephalus melanopogon*) and the Marsh Harrier (*Circus aeroginosus*). From KP 158.9 to 159.1 the pipeline crosses a reedbed within the SPA which is suitable habitat for wintering Moustached Warblers and a potential nesting site for the species. The condition of the habitat that is preferred by the species is the common reed *Phragmites australis* and permanent water throughout the whole year. Additionally
from KP 153.4 to 154.2 two species of high importance that were recorded were the Levant Sparrowhawk (*Accipiter brevipes*) and the Black Stork (*Ciconia nigra*). The Levant Sparrowhawk was found nesting at a close distance from the pipeline (80m) in the area crossed by the pipe in the Nestos river, while Black Storks were observed feeding along the Nestos river. Assuming that no mitigation measures are applied then the impact significance is expected to be moderate.

Within the National Park of Lakes Koronia – Volvi, colonies of the European ground squirrel (*Spermophilus citellus*) may be present. During the field survey no colonies have been detected along the 500 meters corridor. However new colonies may be created before construction works begin as in some areas the habitat is considered as suitable for the establishment of the European ground squirrel. Human disturbance may have a range of effects on the species, from metabolic changes to relocation, while it has also been observed that the species is attracted to human activities (e.g. food availability, i.e. garbage). The sensitivity of the species is high and the magnitude of the impact is considered low to medium. The impact significance, before any mitigation measure is applied, is therefore considered to be moderate to major, in the event that any European ground squirrel colony is finally found to be present within the working area.

Within the Wildlife Refuge of Kirkis, disturbance to the wolf (*Canis lupus*) and several breeding and wintering birds may occur. Seasonal and daily construction restrictions are therefore under consideration to be employed (i.e., construction works restriction period from March to July if possible) whereas no further auxiliary engineering interventions may be allowed to take place there. In this case the impact significance is expected to be minor.

Within the Wildlife Refuge of Agios Timotheos - Kioupia, disturbance to the wolf (*Canis lupus*) may happen and lead to a temporary displacement. Seasonal and daily construction restrictions are therefore under consideration to be used (i.e., construction works restriction period from March to July if possible) whereas no further auxiliary engineering interventions may be allowed to take place there. In this case the impact significance is expected to be minor as the wolf is considered to still remain in the protected area.

A certain degree of disturbance to bird species such as *Falco* spp. *Circaetus gallicus*, *Buteo buteo*, *Emberiza* spp. *Lanius* spp. is expected to occur within the “Petroto- Faraggi - Almira” Wildlife Refuge. High densities of *Melanocorypha calandra*, a ground nesting species were recorded on the area crossed by the pipeline suggesting potential impacts on the breeding
success. As a result the sensitivity of the area with regards to breeding bird disturbance is considered medium and the magnitude of the impact as low to medium because the area affected by the pipeline constitutes a small percentage of the Wildlife Refuge. The impact significance of construction works on the local status of this Wildlife Refuge is considered as being minor to moderate when considering that no mitigation measures are applied.

Disturbance and displacement of species within the “Flamouria - Grammatiko” Wildlife Refuge mainly refers to the presence of large mammals in the area especially the bear or the wolf. However, in Section 6.3.3.2.5 it is shown that the refuge is not among the preferred areas (either by homesite or by presence) for these species of main concern (i.e. Ursus arctos and Canis lupus). As a result the sensitivity of the area with regards to the disturbance of large mammals is considered low and the magnitude of the impact to be low to medium as both species are sensitive to human disturbance. The impact significance is minor to moderate.

Within the “Kouri” Wildlife Refuge, disturbance and displacement of species mainly refers to Spermophilus citellus colonies. Human disturbance may have a range of effects on the species, from metabolic changes to relocation, while it has also been observed this species is attracted to human activities (e.g. food availability, i.e. garbage). The sensitivity of the species is high and the magnitude of the impact is considered to be low to medium. The impact significance is therefore moderate to major.

8.9.3.2 Mitigation Measures

The mitigation measures to address impacts in protected areas during pipeline construction are similar to the ones presented in the previous sections (see Section 8.7.2.2 and 8.8.2.2). Here mitigation measures that are applicable for the protected areas are highlighted, but this should be read in combination with the measures provided previously. Details on the mitigation measures for the Natura 2000 sites are provided in the corresponding Appropriate Assessments.
8.9.3.2.1 Habitat Loss Mitigation

- Establishment of a working strip to restrict area of impact to within the working corridor;
- Applying the reduced working strip (28 meters wide) where possible, especially within European Habitats and forested areas. Avoidance of mature tree stands, as much as possible;
- In order to avoid fragmentation of habitats, TAP should bundle as close as possible to existing infrastructure which is mainly the existing DESFA pipeline;
- Restoration of sites to their original condition where possible upon completion of construction, with the exception of woody vegetation within the 8 meters wide pipeline protection strip; a reinstatement study will be performed in cooperation with the competent authorities in order to be tailored to the needs of the stakeholders if required;
- Habitat compensation measures should be considered where required to replace permanently lost and damaged habitats. This may include new habitat creation, restoration of damaged habitats, and habitat enhancement;
- Retain original vegetation where possible for reinstatement;
- Establish a pre-construction biodiversity baseline from which all mitigation, restoration, and loss / degradation can be measured;
- Consideration of special crossing techniques (such as HDD) for major river crossings in the protected areas;
- Preparation of an Emergency Response Plan to address potential spills during trenchless crossings (i.e. a bentonite leak to the river);
- During hydrotesting water discharge, no additives such as biocides or oxygen scavengers should be discharged back into the watershed. In case, the use of such additives is necessary the additives will be included in the PLONOR list\(^{42}\);
- All potential water sources should have a minimum discharge rate of 3 m\(^3\)/sec in order to be used for hydrotesting;
- The water abstraction from rivers shall be limited to a maximum of 10 % of the run-off rate during the abstraction period;
- Work is to be supervised by an on-site Ecological Clerk of Works (ECoW); and Ecological awareness training should be provided to all personnel;

\(^{42}\)OSPAR List of Substances Used and Discharged Offshore which Are Considered to Pose Little or No Risk to the Environment (PLONOR)
8.9.3.2.2 Species Loss Mitigation

- Reduce vehicle speed while travelling along the working strip;
- Fauna species should not be caught or killed during construction;
- Construction works should be avoided during the breeding season (from March to end of June) to the extent that is possible, in the protected areas;
- Carry out a pre – construction survey to assess the potential expansion of *Spermophilus citellus* colonies in the areas identified as of high species presence potential;
- Manually remove tortoises that are found in the working strip during construction;
- At trenches, trench plugs to be incorporated every 100 meters and daily fauna retrieval to be conducted;
- Applying the reduced working strip (28 meters wide) where possible, especially within European Habitats and forested areas;
- Consider soil tiling to enable temporary displacement of *Spermophilus citellus* colonies\(^{43}\) present in the working strip at “Kouri” wildlife refuge;
- A walkover along the route has to be carried out prior to construction in order to survey for the potential presence of important nesting species for the sites. This will ensure that any site specific issues will be highlighted before construction (e.g. ground nesting birds, otter dens, reptile nests);
- In the vicinity of the Kompasatos River and Nestos River crossings any stock-piled soil will be covered with netting to prevent birds, especially *Riparia riparia* from making nest burrows therein;
- Identification of protected and endemic flora species prior to vegetation clearance and their transplantation if required; and
- If nests are located, no works will to be carried out within a 25 meters buffer of the nest site until chicks have fledged from the nest or it is abandoned, or otherwise, proper additional measures shall be determined through a special ornithological study.

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8.9.3.2.3 Disturbance / Displacement of Species Mitigation

- Where possible undertake vegetation clearing (of trees, bushes etc.) of pipeline working strip and construction sites before or after the breeding season, i.e. before March 1st or after September 30th;

- On protected areas with potentially important breeding bird habitats, discourage birds from breeding by installing plastic bands (e.g. warning tape) that flutter in the wind, before the breeding season starts i.e. before March 1st. (Birds are then likely to avoid breeding on and along the construction strip, and when the pipeline construction starts the presence of breeding birds will be minimised);

- If it is a necessity to clear vegetation within the period 1st March- 31st July (bird breeding season) then pre-vegetation clearance surveys will be undertaken by qualified ornithologists focusing on mature trees and riparian vegetation. If any nests of species of conservational interest are located within the vicinity of the working strip, then no works will be carried out within at least a 25 metre buffer of the nest site until either the chicks have fledged from the nest or the nest is naturally abandoned. Otherwise, relocation of the nest, depending on whether this is acceptable to the species, could be investigated.

- Consideration of the adoption of construction restriction times, on a case by case basis according to the relevant breeding season of each species of interest found in the various protected areas.

- No water abstractions or discharges will be conducted on any of the water bodies, without appropriate authorization from the competent public authorities

- Access to the works area will only be allowed to site staff;

- Include management actions for threatened/ protected species within the Biodiversity Action Plan (as part of the ESMMP);

- Use of directional lighting;

- In sites where species of conservational interest have been verified, at a distance of smaller than 500 metres, then if required, screens around the work area will be used as a buffer to mitigate potential impact from visual/light/noise sources. If necessary, special noise reduction measures should be installed around the generators and the pumps that will be used for the HDD and the Hydrotesting;

- Night working should be limited and the use of lighting along the corridor minimised;

- Any access roads that were improved to allow potential access to protected areas will be reinstated after construction activities are finished;
Consider soil tiling to enable temporary displacement of *Spermophilus citellus* colonies present in the working strip;

Work is to be supervised by an on-site Ecological Clerk of Works (ECoW); and

Ecological awareness training should be provided to all personnel

8.9.3.3 Residual Impacts

The implementation of the above mentioned mitigation measures will minimize the impact significance for the protected areas. The associated residual impacts are presented in Table 8-64. It is reiterated here that the presented mitigation measures are not stand alone measures and that they should be read in conjunction with the measures presented for each impact within Sections 8.7.2.2 and 8.8.2.2.

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitat Loss</td>
<td>• Establishment of working strip to restrict area of impact to within working corridor;</td>
<td>MINOR to NOT SIGNIFICANT</td>
</tr>
<tr>
<td></td>
<td>• Applying the reduced working strip (28 m wide) where possible, especially within European Habitats</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and forested areas;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Restoration of sites to their original condition where possible upon completion of construction;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Close collaboration with the competent authorities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Retain original vegetation where possible for reinstatement.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Establish a pre-construction biodiversity baseline</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Preparation of an Emergency Response Plan to address potential spills during trenchless crossing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(i.e. a bentonite leak to the river);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Careful design and execution of the hydrotesting procedure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Carry out a pre-construction survey to assess the potential expansion of <em>Spermophilus citellus</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>colonies in the corresponding protected areas;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Work to be supervised by an on-site Ecological Clerk of Works;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Ecological awareness training should be provided to all personnel;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Consider the adoption of construction restriction</td>
<td></td>
</tr>
</tbody>
</table>

### Impact / Risk | Measures to Address the Impact / Risk | Significance of Residual Impact / Risk
---|---|---
**Construction Phase**<br> periods according to the breeding season of the species in concern (mainly March-July).<br> • Avoid mature tree stands where possible.<br> • Bundling with existing infrastructure (DESFA).<br> • Habitat compensation measures should be considered where required to replace permanently lost and damaged habitats.<br> • A detailed survey prior to construction is recommended in order to detect presence of the species of conservational interest within the final working strip along protected areas.<br><br>**Loss of Individuals**<br> • Reduce vehicle speed while travelling along the working strip;<br> • Fauna species should not be caught or killed during construction;<br> • Manually remove tortoises that are found in the working strip during construction;<br> • At trenches, trench plugs to be incorporated every 100 m and daily fauna retrieval to be conducted;<br> • Narrow down the working strip while crossing the forest areas to the extent that is possible;<br> • A walkover along the route has to be carried out prior to construction in order to survey for potential presence of important nesting species for the protected areas.<br>• Carry out a pre – construction survey to assess the potential expansion of *Spermophilus citellus* colonies in the protected areas (National Park of Koronia – Volvi, WRA of Kouri);<br>• Consider translocation of *Spermophilus citellus* if colonies are found;<br>• Identification of protected and endemic flora species prior to vegetation clearance and transplantation if required.<br><br>**Species Disturbance and Displacement**<br> • Consider avoiding construction works during the period March to July in the protected areas to ensure that birds and relevant species are not disturbed during the breeding season;<br> • Narrowing of the working strip, if possible along protected areas, especially in forested areas;<br> • Where possible undertake vegetation clearing before or after the breeding season, i.e. before 1st March or after September 30th.<br> • Discourage bird breeding on pipeline route sections with important breeding birds’ habitats, by installing plastic bands fluttering in the wind before the breeding season starts (March 1st).<br> • If it is a necessity to clear vegetation within the period 1st March-31st July (bird breeding season) pre-vegetation clearance surveys will be

**MINOR**<br>Minor impacts related to loss of individuals are expected for the protected areas.

**MINOR**<br>Minor impacts related to species disturbance are expected for protected areas.
<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| Construction Phase | undertaken by ornithologist. Should nests of species of conservational interest be located, no works will be carried out at least within a 25 m buffer from the nest (or more depending on the species) until chicks have fledged from it or it is naturally abandoned. Avoidance of work or relocation of nest, according to species.  
- Within protected areas avoid dawn-dusk works;  
- Avoid blasting activities to the extent possible.  
- Access to the works area will only be allowed to site staff;  
- Include management actions for threatened/protected species within the Biodiversity Action Plan (as part of the ESMMP);  
- Use of directional lighting;  
- In sites where species of conservational interest have been verified, at a distance smaller than 500 m, then if required, screens around the work area will be used as a buffer to mitigate potential impacts from visual/light/noise sources. If necessary, special noise reduction measures should be installed around the generators and the pumps that will be used for the HDD and the Hydrotesting;  
- Any access roads in protected areas will be reinstated after construction  
- Pre-construction survey to be developed;  
- Consider temporary displacement of *Spermophilus citellus* colonies present in the working strip at “Kouri” wildlife refuge and along the NP Koronia-Volvis if any are found;  
- Consider translocation if found;  
- Work to be supervised by an on-site Ecological Clerk of Works;  
- Ecological awareness training should be provided to all personnel; | |


8.9.4 Operation and Maintenance Phase

8.9.4.1 Potential Impacts

No significant impacts to protected areas are envisaged during Project operation. As part of the pipeline route management, the pipeline protection strip (8 m width) will be kept free from any deep-rooting vegetation. In forested areas (such as GR1110009, WRA of Kirki, WRA of Agios...
Timotheos, WRA ‘Flamouria – Grammatiko’) there are cases when the PPS has been used as a fire protection belts. In grasslands and agricultural areas, no impact whatsoever will incur since shallow rooted species will be allowed to fully grow on top of the pipeline.

Noise from the operation of the compressor stations could be considered as a source of impact. However, both compressor stations have been carefully selected to be at a significant distance from the nearest protected area.

The 8 m pipeline protection strip is not deemed sufficient to fragment the protected areas or to pose any barrier to the movement of species. Only limited adverse impacts on fauna should be expected (displacement of bear and wolf denning sites by the loss on the degree of habitat suitability along the PPS), However this effect is not assessed to be significant when considering the whole extent of the protected areas and the limited surface affected. In addition, positive impacts could be created for species which are favored by openings and edges along thick vegetation, such as birds or the jackal.

Consequently, impacts to the qualifying features of the protected areas are assessed as not significant during operation of the project.

In case that any external pipeline maintenance becomes necessary, i.e. digging up of a pipeline section for repair (which will be an exceptional case), impacts and mitigation at the particular location will be similar to those of the construction stage.

8.9.4.2 Mitigation Measures

No mitigation measures are deemed necessary for the integrity of the protected areas during the operation of the project. The following are general mitigation measures that should decrease the overall footprint of the project to the environment.

Nearby access roads improved during construction stage (none within protected areas, nearest improved road is 800 m to the SW of Flamouria-Grammatiko site) will be reinstated for the operation stage in order to restrict access. This will reduce any disturbance to large mammals in
the area. All possible nearby access roads will be used within the protected sites so as to eliminate any potential disturbance impacts to fauna species.

Collaboration with the forest authority in order to maximize the benefit from the creation of the PPS. Although PPS to be used as a forest track, is not fully acceptable, the PPS could be expanded, as somehow differently modified, in order to fit to any managerial objectives that the management body of the forest (or the protected area) can plan (e.g. as firewall).

In order to protect physical and natural environment, restriction of deep rooted species from growing on top of the pipeline will be achieved by physical means; no application of herbicides, defoliant etc. will be allowed.

8.9.4.3 Residual Impacts

No adverse residual impacts are assessed on the protected areas during operation of the project.

8.9.5 Decommissioning Phase

8.9.5.1 Potential Impacts

Depending on the approach and technologies available at decommissioning stage, the pipeline may either stay in the ground or will be taken out partly or completely. Regarding impacts to protected areas, in the case of taking the pipeline out, impacts will be similar to construction stage.

8.9.5.2 Mitigation Measures

In case the pipeline is taken out of the ground, mitigation measures will be the same or similar to the ones described for construction. Mitigation measures will be planned according to the best practice available at the time of decommissioning (i.e. in 50 years).
8.9.5.3 Residual Impacts

Residual impacts from construction will either remain similar or be aggravated by decommissioning; especially in case the pipeline is taken out of the ground and construction activities will occur in reverse order. In case the pipeline is left in situ, no impacts are anticipated.

8.9.6 Summary of Impacts on Protected Areas

Several protected areas are crossed by the project. Most of them are overlapping. The selection of a trenchless methodology (such as HDD) to cross Filiouris, Kompsatos, Nestos and Axios Rivers avoids any impact on protected qualifying features (habitats and species) of those Natura 2000 sites. Areas within the crossed protected sites where construction activities will take place are mostly agricultural land without particular conservation significance. The Habitats Directive Appropriate Assessments undertaken (refer to Annex 8.6 to 8.11) show that the conservation objectives for protected sites will not be compromised by the proposed development, nor by any cumulative effects and that no significant impact is anticipated on any of the species nor habitats for which the sites have been designated. However, all appropriate preventive and mitigation measures must be applied.

8.10 Economy, Employment and Income

8.10.1 Overview

This section assesses the potential economic and employment impacts associated with the Project in Greece. The assessment is divided into the three main phases of the Project: construction, operations and decommissioning. The construction phase also includes an assessment of impacts associated with pre-construction (road upgrades and camp construction). Summaries of the inputs to the assessment and the geographic focal points for predicted impacts are presented in Box 8-9.
Potential economic impacts relating to local livelihoods are covered separately in Section 8.11 Land and Livelihoods. Potential positive and negative economic impacts relating to Project impacts on infrastructure are covered in Section 8.12 Infrastructure and Public Services.

### Box 8-9 Key Considerations for Assessment – Economy, Employment and Income

<table>
<thead>
<tr>
<th>Sources of Impact/Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-construction and Construction: a peak construction workforce of 2,700 employees is estimated for the main construction phase; including a 600 person workforce to construct GCS00 and a 100 person workforce to construct the initial stage of GCS01 - a pig station for 10 BCM/yr system transport capacity (the fitting of the compressor units at GCS01 for the 20 BCM/yr case will require a smaller workforce of 350 - 400 people at a later stage): estimated pre-construction workforce figures are not available at this time. The estimated duration of work: 3-7 months for pipeline spreads and 24 months for GCS construction. Worker hiring and procurement of materials will be managed by primary contractors but required to meet EBRD standards, EU requirements and TAP policies (e.g. on CSR); construction camps will be self-contained but workers will have some access to local markets.</td>
</tr>
<tr>
<td>Operations: taxes to be paid will be negotiated in the Host Government Agreement; these are expected to amount to 20 to 25 (€) millions per year. Permanent workforce is estimated to be &lt;150 employees.</td>
</tr>
<tr>
<td>Decommissioning: workforce for decommissioning the pipeline will depend on the approach taken (abandon in place or remove) but would likely be also much smaller than construction workforce.</td>
</tr>
</tbody>
</table>

### Potentially Impacted Resources and Receptors

- Business and workforce in the study area.
- Settlements along the pipeline route, in particular those located near construction camps and compressor stations.

### Geographic Distribution of Impacts/Risks

- Settlements located near construction camps: Amfitriti, Itea, Aspri Ammos, Toumba, Krithia, Paralimni, Antigonos, Ampelokipoi...
- Populated areas close to construction camps will have more significant employment and local spending impacts.

### Particular Baseline Conditions that are Potentially Influencing Impacts/Risks

- Education and skill levels: School completion rates in the regions are relatively high (between 80-88% in 2011). Construction is an important industry in some municipalities, particularly in Nestos in East Macedonia-Thrace and Eordea and Amyntaio (11% of the workforce) in West Macedonia. The detailed availability of workers with construction and pipeline related skills at the national and local level will be assessed as part of TAP AG’s local content process. At this stage of the Project it is estimated that a 70-80% of labour positions will be filled by skilled workers.
- Availability of goods and services: The services industry is a major employer at a regional level and there are several larger settlements within the social study area that offer a range of services and provide goods to the surrounding population. In addition, there are several cities within a short distance to the pipeline corridor that offer a full range of services.

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45 Foundation for Economic and Industrial Research (IOBE) – *Economic Benefit Study* (2013)
High importance to local stakeholders: Employment is currently a prominent issue in Greece with 17.7% of the total population and 44.4% of 15-24 year olds unemployed nationally; unemployment levels in all regions are higher than for the country as a whole. In the social study area, more than 90% of surveyed households identified employment as one of their top three development concerns.

Vulnerable Groups

- Young people: Approximately 44.4% of people aged 15 - 24 are unemployed in Greece; young people are not as active in the local community and extra measures may be needed to reach them with information on the Project during future stages of stakeholder engagement.
- Roma: Roma groups typically have lower levels of literacy and formal education and may face discrimination and exclusion from local communities; extra measures may be needed to reach them with information on the Project during future stages of stakeholder engagement.
- Low-income Households: Low-income households have fewer resources to rely on and are less likely to have savings and/or access to credit, which make them vulnerable to shocks and change.

References

- Baseline is found in Section 6.4.4. Impact Assessment Criteria is found in Annex 5.8. Monitoring Measures are described in Section 9.2.

ERM (2012) and ASPROFOS (2013)

Table 8-65 presents the key impacts of the Project on economy and employment during the three major Project phases.

<table>
<thead>
<tr>
<th>Pre-Construction and Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary direct and indirect employment opportunities (primarily unskilled)</td>
<td>Long-term employment in maintenance, monitoring and security positions</td>
<td>Temporary direct and indirect employment opportunities near the construction sites</td>
</tr>
<tr>
<td>Temporary economic impact from taxes and fees, procurement and worker spending</td>
<td>Economic impact of taxes paid to the national government</td>
<td>Temporary induced economic impact from worker spending in the local area</td>
</tr>
<tr>
<td>Long-term benefits of capacity enhancement (on-the-job and formal training opportunities)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ERM (2012)

Due to the stage of Project development, there are a number of aspects of the Project yet to be defined that influence the magnitude of the impact to economy and employment. These include:

- the size of some components of the pre-construction and construction workforce;
- results of the Project’s supply side analysis and elaboration of a procurement plan.

The following Sections discuss economic and employment impacts relating followed by the mitigation measures that will be adopted by the Project.
8.10.2 Construction and Pre-commissioning Phase

8.10.2.1 Potential Impacts

8.10.2.1.1 Temporary Employment Impacts

As a pipeline scheme, most of the economic and employment impacts from the Project can be expected to accrue during the pre-construction and construction phases. It is during this period that the Project will need to hire and accommodate workers and purchase goods and services, potentially resulting in positive impacts on the local communities. Temporary employment during the construction phase includes people directly employed by the primary contractor for the construction and upgrading of roads and infrastructure (pre-construction) and construction of the pipeline and other project components. It also includes jobs supplying the goods and services needed to support the construction process, including food and transport services and support staff in construction camps.

Employment figures for the construction stage are only preliminary at this stage and will be further refined during detailed design and following selection of a primary contractor. Current estimates of workforce size and the duration of work for the different Project components are provided in Table 8-66.

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Estimated Duration</th>
<th>Estimated Workforce</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Construction (infrastructure upgrades)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access Roads</td>
<td>9 months</td>
<td>Not available</td>
</tr>
<tr>
<td>Establish 17 Pipe storage yards</td>
<td>Approximately 2-3 weeks</td>
<td>Not available</td>
</tr>
<tr>
<td>Establish 8 construction camps</td>
<td>Approximately 4-6 weeks</td>
<td>Not available</td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buried 543 km cross-country pipeline</td>
<td>Approximately 3-7 months per spread, depending upon difficulty of terrain</td>
<td>1,500&lt;sup&gt;47&lt;/sup&gt;</td>
</tr>
<tr>
<td>22 block valve stations</td>
<td>(included in the pipeline construction)</td>
<td>(included in the pipeline construction)</td>
</tr>
<tr>
<td>Compressor Station GCS00</td>
<td>24 months</td>
<td>600</td>
</tr>
</tbody>
</table>

<sup>46</sup>The pipeline will consist of total 14 spreads of approximately 30 – 60 km in length. For a breakdown of the expected length and duration of work for each spread, see Section 4.5.2.4 in the Project Description Section.

<sup>47</sup>Pipeline construction of TAP Greece East and TAP Greece West will take place simultaneously.
In accordance with EU regulations regarding competition and procurement, the Project cannot preferentially hire Greek nationals for unskilled labour positions. Hence, no targets for nationals as a percentage of the workforce have been set. In total, an estimated 2,700 jobs will be created during peak pipeline construction; of these, an estimated 20-30% (approx. 540-810 jobs) will be filled by unskilled workers. However, as outlined above and as part of TAP’s Local Content Strategy, TAP will provide training for local workers, like welders etc. Further measure to raise local workforce hiring rates are presented in below recruitment process.

Generally speaking, the duration of employment for the construction workforce will be brief. The longest-term assignments will be for work on the compressor stations GCS00 and at a later stage GCS01. Construction of the pipeline itself will take place in 14 separate spreads, with work on each individual spread anticipated to last 3–7 months, depending upon the difficulty of the terrain. Each compressor station will be constructed over an estimated 24-month period.

Employment is currently a prominent issue in Greece with 17.7% of the total population and 44.4% of 15-24 year olds unemployed nationally (see Section 6.4.4.1, Table 6-65) in the socioeconomic baseline). In the regions crossed by the pipeline, unemployment figures are slightly higher than the national picture: in 2010 total unemployment was 19.9% in East Macedonia, 19.5% in Central Macedonia and 23.2% in West Macedonia. Unemployment is a grave concern for residents within the social study area with over 92% of all surveyed households in Greece reporting employment as a great community challenge and one of their top three development concerns. Questions relating to employment were more prominent in some areas of the social study than others, with the majority found in East Macedonia-Thrace. In Alexandroupoli, Maroneia-Sapes and Iasmos, employment questions constituted between 12 - 25% of all questions asked during consultation process. Employment concerns include questions relating to the number of local people expected to be employed by the project, but also negative questions targeting the perceived lack of benefits for local communities along the route.
Stakeholders indicated that for them to perceive benefits these will need to accrue locally and that they will be hostile to ‘outsiders’ taking work that could be performed by local residents.

At both the national level and in some municipalities crossed by the pipeline, it is expected that there will be a moderate number of semi-skilled workers with experience in the construction industry. Nationally, construction contributes to 3 – 4% of Greek GDP. There have been several major infrastructure projects in the country in the past decade, including construction of the Egnatia highway and infrastructure upgrades for the Athens Olympics, all of which involved Greek companies and workers to varying extents. In the regions crossed by the Project, Nestos, Eordea and Amyntaio have the largest number of people employed in the construction industry (approximately 11% of workers). In Eordea, in TAP Greece West section, these figures are even higher within the 2 km pipeline corridor: 25% of household survey respondents reported working in the construction industry in this area. In TAP Greece East section, the highest figures were reported in Nestos where 11% of household survey respondents were employed in construction.

Historically, the mining and energy industries have supported a large number of construction jobs in the area of Eordea in West Macedonia and household survey respondents in Nestos, Iasmos and Kavala (in Central Macedonia-Thrace) reported being employed in mines and quarries (11%, 5% and 4% respectively). As a result, workers with experience in road building, heavy machinery and site preparation may be present in the study area. In the forested areas of the pipeline corridor in Edessa (Central Macedonia) where the majority of households are involved in the logging industry, with relevant experience for preparation of the working strip (e.g. land clearing). Similar experience may also be found in the forested areas of Alexandroupoli, Komotini and Kavala (East Macedonia-Thrace); although the industry is smaller in these areas and employs fewer people so the required skills are less likely to be as abundant.

Despite the presence of construction workers and contractors at both the national and municipal level in Greece, a large proportion of skilled positions on the Project will require specific technical experience in pipeline construction. Given the global nature of the industry, it is expected that the majority of skilled positions during pipeline construction will be filled by international workers.

48 2001 Census, Hellenic Statistical Authority
The purchase of goods and services during construction may generate some local employment opportunities, mainly in nearby cities (Alexandroupoli, Komotini, Kavala, Xanthi, Serres, Thessaloniki, Ptolemeida, Kastoria) and in settlements close to the construction camps (eight camps for pipeline construction and one camp for each compressor station—refer to Figure 8-30). The compressor station camps will be in place for at least 24 months. It can be expected that each of the construction camps will employ unskilled and semi-skilled workers to provide housekeeping, meals, security and transport services (numbers and positions not yet estimated). At a regional level, the services sector employs the majority of people in both East and West Macedonia, and both regions have relatively healthy tourism and service industries. As a result, people in the study area are likely to have relevant experience for support and service-related opportunities.

It is not known what percentage of food or supplies for the Project will be procured from Greek companies, but it can be expected that any associated job creation will mostly accrue in larger cities, such as Alexandroupoli, Kavala, Thessaloniki and Ptolemeida. The total amount of job creation associated with procurement is expected to be small.

Vulnerable groups in the employment context include young people, the Roma and low-income families. As noted previously, youth unemployment rates are high in Greece and the issue was raised specifically by some stakeholders. Generally speaking, young people are less involved than their elders in community groups and decision-making in the study area, with the consequence that they were not present to express their own concerns at community meetings. This may also mean that as a group they are less well positioned to hear about and respond to project opportunities.

Women are also less involved in community decision making, they rarely have access to an independent income source and their participation in the workforce is bound to their home. However, as a group women are not considered vulnerable as they are often responsible for household decision making (including financial) and are not likely to participate in any available employment opportunities. Thus, they are not likely to be impacted more than other household members. To ensure women are included in the decision making process and information sharing, TAP AG will continue to engage directly with women throughout all project phases.
Low-income families are found throughout the social study area, however, they are particularly prevalent in East Macedonia-Thrace where 40% of surveyed households in Alexandroupoli, Maronia-Sapes and Komotini earn less than €700 a month. These households are less resilient to change and often have less access to development opportunities due to lower education and skill levels. The Roma are also vulnerable due to low school completion and literacy rates and low participation in the workforce. There is also a high level of hostility towards the Roma in some Greek communities, making the Roma vulnerable to discrimination and exclusion from opportunities should these arise. Official data on the Roma are not available, making it difficult to fully assess their level of integration within local communities and economic activities, so the assessment conservatively assumes that this level is extremely low.

In summary, employment benefits will be limited by the short construction period and relatively small number of positions open to unskilled workers. Workers with experience in construction, land clearing and the services industry are present in the study area and could benefit from some of the skilled and semi-skilled opportunities associated with the Project. However, detailed breakdowns of the number and duration of these positions are not yet available. Depending on how workers are recruited, employment opportunities for local communities may be most significant near construction camps – due to additional employment generated by procurement of services for campsite operation - and where road construction is needed.

8.10.2.1.2 Economic Impacts during Construction

Economic impacts during pipeline construction will stem from procurement of goods and services by the Project, induced economic effects of spending by Project employees, and payment of taxes to the government.

Detailed information on the procurement needs for the construction phase is not yet available. In general terms, the types of goods and services required will include:

- Transport, catering, laundry, food supply, security services for camps;
- Supply of construction vehicles and equipment;
- Provision of construction materials including aggregates/sand, concrete, and building materials.
It is not known at this stage what materials can be sourced locally, so the assessment conservatively assumes that most services (including transport, laundry, catering, etc.) will be sourced from Greek companies and only a small percentage of goods (some of the more basic vehicles and construction materials) will be sourced from Greece.

National and regional level companies will be included in the opportunity to tender for construction contracts. A study has been performed by IOBE showing detailed benefits at a national level which are expected to be a direct contribution of €320 million to the Greek GDP\(^4\). A Project demand and supply side analysis is ongoing which aims to provide more detail on local level capabilities. However results were not available for inclusion in the ESIA.

The economic impact from purchase of goods and services will primarily accrue at a regional or national level rather than at the municipal level unless local community procurement is specifically targeted by the Project.

The economic impact of spending in the local economy by Project employees is expected to be relatively minimal, due to the presence of self-sufficient construction camps and the relatively short duration of the construction period. The Project will provide transport for managed visits to local population centres during recreational time for workers, which can be expected to generate some income for local communities. Vending sites will not be permitted at the camp perimeters, so any purchasing will primarily benefit local tradesmen, café owners and others with existing formal businesses. In the study area, settlements in Nestos and Kavala (East Macedonia), Oraiokastro, Chalkidona and Pella (Central Macedonia) and Kastoria and Orestida (West Macedonia) have mixed economies, with many households running small shops or commuting to work in trade or services in nearby population centres. Hence, small business owners in the area may be well positioned to benefit from employee spending.

In summary, while Project construction will result in some economic benefits at the regional and local level, these are expected to be fairly limited due to the brief duration and small workforce required. Services procurement (e.g. employment in construction camps, food and transportation) will be the most likely source of economic impact at the local level, but the overall scale of impact will be relatively limited.

\(^4\)Foundation for Economic and Industrial Research (IOBE) – *Economic Benefit Study* (2013)
8.10.2.1.3 Skills Enhancement during the Construction Phase

In general, given the short timeframe for the pipeline construction phase there will be limited possibility for unskilled workers to develop other skills. However, as the construction duration of the compressor stations will be longer, it is expected that there will be greater opportunities for on-the-job training and learning for the workforce on these components.

In addition to training and experience at the level of individual workers, the Project will also present an opportunity for Greek companies to tender for work on components of pipeline construction. If and where these contracts are won, there will be the possibility for capacity enhancement and strong reputational benefits from working on a major international project to the highest safety and performance standards.

8.10.2.2 Mitigation Measures

TAP AG’s Policy on Corporate Social Responsibility (CSR) contains the commitment that “TAP and its sub-contractors will recruit and source locally, work with local businesses and give preference to both.” The Project plans to achieve this objective through the implementation of a Local Content Strategy aimed at enhancing capacity of national level companies and increasing local (Project Area) employment and procurement wherever possible. Specific mitigation measures included under this strategy include the following:

8.10.2.2.1 Enhancement of National Supplier Capacity

- In order to identify and quantify local content potential, identify potential employees, contractors and suppliers and obtain information on their capability to comply with TAP AG’s performance requirements, TAP AG will conduct a comprehensive demand- and supply side analysis.
- TAP AG will implement a phased capacity building programme (sector by sector) that will enable local companies to achieve qualifications and potentially certification with the relevant standards and requirements well in advance of the tendering process.

50 TAP Policy on CSR (2011) (TAP-HSE-PO-0002)
51 TAP Local Content Strategy (2010) (TAP-HSE-ST-0007)
• TAP AG will engage with local government, industry and other organisations to determine opportunities for targeted training

• Following selection of primary contractors, the Project will carry out training of contractors on the Project HSE and social policies prior to the start of construction.

• Where TAP AG’s supply and demand analysis demonstrates existing capacities in the study area – e.g. loggers in Edessa municipality, construction firms in Nestos, Eordea and Amyntaio municipalities – the Primary Contractor will be required to reach out to these groups when advertising work opportunities on the Project.

8.10.2.2.2 Integrity of Recruitment Process

• In order to obtain information on local preferences, to enhance transparency and to strengthen the local buy-in, TAP AG will discuss the potential for local involvement during construction and operation with the communities as part of the Project’s demand and supply side analysis.52

• The Employment Strategy will define target locations at the local level for recruiting skilled and unskilled labour by each of the fourteen working spreads. This will help to smooth the distribution of employment opportunities along the pipeline route. Hiring will be done remote from the work front and construction camps.

• The Project will work with local authorities and employment organisations to ensure that all positions are advertised in a manner that is accessible to the settlements and communes crossed by the pipeline.

• The Project will ensure that the recruitment process is fair and transparent, public and open to all regardless of ethnicity, religion or gender,

• The Project will identify female employment opportunities where possible and advertise them accordingly;

• The Project will stipulate that the Primary Contractor provides clear contracts prior to mobilisation stipulating working hours, pay, and other terms of employment.

52 TAP Local Content Strategy (2010) (TAP-HSE-ST-0007)
8.10.2.2.3 Managing Public Expectations

- The Project will provide clear information on the number and limited timescales of employment opportunities. Information on the employment strategy will be disclosed at a municipality level, at all settlements within the pipeline corridor (1 km corridor where the pipeline runs parallel to the existing DESFA pipeline network and 2 km corridor where there is no existing network or the pipeline deviates from the existing pipeline corridor), and in communities near construction camps. Information will also be provided to Roma groups in the area where it is possible to engage them.

- Care and attention will be given to ensure that all members of the community are provided with information on Project recruitment practices. This includes vulnerable groups such as young people, Roma and low-income households.

8.10.2.2.4 Sourcing Local Goods and Services

- As part of the tendering process, contractors will be required to develop a purchasing strategy that stipulates how national and local purchase of goods will be optimised. The purchasing strategy will be required to adhere to EU regulations as well as all TAP policies and procedures, including CSR and HSE.Agreed measures will be monitored and reported on.

- Immediately upon opening a tender the Project will make information on tendering opportunities available to local businesses through trade and industry chambers and local business organisations along the pipeline route.
8.10.2.3 Residual Impacts

Table 8-67 Residual Impacts – Economy and Employment – Construction Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Phase</td>
<td></td>
<td>(green shading denotes a ‘positive’ residual impact)</td>
</tr>
<tr>
<td>Temporary employment opportunities— national level</td>
<td>TAP AG will enhance national supplier capacity through a comprehensive demand and supply side analysis, phased capacity building program, targeted training agreed with local government, industry and other organisations. (TAP Local Content Strategy (2010) (TAP-HSE-ST-0007))</td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>• The Employment Strategy will outline and require a fair and transparent recruitment process for all openings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The Project will identify female employment opportunities where possible and advertise them accordingly.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporary employment opportunities— local level</td>
<td>TAP AG will agree an Employment Strategy with Primary Contractors to outline and require a fair and transparent recruitment process for all openings.</td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>• The Employment Strategy will require contractors to advertise skilled and unskilled openings thoroughly and well in advance of hiring at the municipal and local level across the pipeline route. This will apply to both construction jobs and supporting services. TAP AG will monitor these efforts prior to and during construction. The Employment Strategy will define target locations at the local level for recruiting skilled and unskilled labour by each of the fourteen working spreads. This will help to smooth the distribution of employment opportunities along the pipeline route. Hiring will be done remote from the work front and construction camps.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The Project will provide clear information on the number and limited timescales of employment opportunities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Where TAP AG’s supply and demand analysis demonstrates existing capacities in the study area – e.g. loggers in Edessa municipality, construction firms in Nestos, Eordea and Amyntaio municipalities – the Primary Contractor will be required to reach out to these groups when advertising work opportunities on the Project.</td>
<td></td>
</tr>
<tr>
<td>Temporary employment – vulnerable groups</td>
<td>TAP AG will require the Primary Contractor to explicitly include Roma camps and community leaders in the advertisement effort for job openings.</td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td></td>
<td>TAP AG will identify and work with local organisations and community leaders to develop explicit strategies to ensure that all members of the community can access information on employment opportunities. This includes young people and low-income and low-skilled families.</td>
<td></td>
</tr>
<tr>
<td></td>
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</table>
**Project Title:** Trans Adriatic Pipeline – TAP  
**Document Title:** Section 8 - Assessment of Impacts and Mitigation Measures

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| Temporary economic impact – national level | • TAP AG will enhance national supplier capacity through a comprehensive demand and supply side analysis, phased capacity building program, targeted training agreed with local government, industry and other organisations. (TAP Local Content Strategy (2010) (TAP-HSE-ST-0007))  
• As part of the tendering process contractors will be required to develop a purchasing strategy that stipulates how national and local purchase of goods and services will be optimised. Agreed targets will be monitored. | MINOR  
• Due to the brief construction period and the uncertainty of local procurement estimates at this time, the economic impact of sourcing goods and services relative to the national economy are estimated to be minor.  
• The Project will pay taxes and permitting fees during the construction phase, but these will be relatively minor. |
| Temporary economic impact – local level | • Immediately upon opening a tender the Project (TAP or the Primary Contractor) will make information on tendering opportunities available to local businesses through trade and industry chambers and local business organisations along the pipeline route.  
• As part of the tendering process contractors will be required to develop a purchasing strategy that stipulates how national and local purchase of goods and services will be optimised. Agreed targets will be monitored. | MINOR  
• Temporary impact  
• Local purchasing by employees expected to be relatively minor; impacts may be slightly larger in small cities such as Alexandroupoli, Komotini, Xanthi, Kavala, Serres, Thessaloniki, Kastoria, and Ptolemeida, where more goods and services are available for purchase  
• Impacts will be more significant in the settlements near the compressor stations due to the larger duration of work. However, the overall impact rating is considered minor relative to local economies. |
| Skill and Capacity Enhancement | • TAP AG will enhance national supplier capacity through a comprehensive demand and supply side analysis, phased capacity building program, targeted training agreed with local government, industry and other organisations. (TAP Local Content Strategy (2010) (TAP-HSE-ST-0007))  
• TAP AG will carry out training of contractors on Project HSE and social policies prior to the start of construction. (TAP Local Content Strategy (2010) (TAP-HSE-ST-0007)) | MINOR  
• Long-term impact  
• Significant benefit for companies and individuals associated with the project  
• Relatively limited training opportunities given the short duration of construction |

*Source: ERM (2012) and ASPROFOS (2013)*
8.10.3 Operation and Maintenance Phase

8.10.3.1 Potential Impacts

8.10.3.1.1 Employment Impacts

During operations, the Project in Greece will employ less than 150 permanent employees. The exact staffing numbers and organisational needs will be made available following the completion of the detailed design. Permanent employees will be needed for the following areas of work:

- Operation and maintenance of the pipeline system;
- Monitoring;
- Security; and
- Maintenance of the 8 m pipeline protection strip (PPS) in forested areas.

The total number of permanent jobs created by the Project will be relatively small. The majority of these will be skilled positions and will be based around the compressor stations, near Kipoi (GCS00) and Serres (GCS01) at a later stage. It is unknown at this time whether local security personnel will be hired at points along the pipeline route, which could create some job opportunities within local communities.

8.10.3.1.2 Economic Impacts

The primary economic impact during the operations phase will be the payment of taxes to the Greek government. Advanced Pricing Agreements (APAs) between Switzerland and each of the host countries (with similar content) will finally define the income allocation amongst Switzerland (TAP head office) and the host countries (TAP permanent establishments). The Host Governmental Agreements (HGAs) with Greece will specify how the countries taxes this income and all other applicable taxes (e.g. VAT, customs, property tax, stamp duty, special levies etc.). The APA will have a duration of minimum 25 year (the whole operations phase). IOBE has estimated as part of their study that over the lifetime of the Project the Greek Treasury will benefit from €1.2 billion in taxes.53

53Foundation for Economic and Industrial Research (IOBE) – *Economic Benefit Study* (2013)
8.10.3.2 Mitigation Measures

As in the construction phase, TAP AG will undertake measures in order to optimise national and local level employment opportunities, maintain the integrity of the recruitment process and where possible source goods and services locally. See Section 8.10.2.2 for more detail.

8.10.3.3 Residual Impacts

<table>
<thead>
<tr>
<th>Operations Phase</th>
<th>Significance of Residual Impact / Risk (green shading denotes a 'positive' residual impact)</th>
</tr>
</thead>
</table>
| Permanent Employment Opportunities (national and local) | NOT SIGNIFICANT  
- Very few permanent opportunities – particularly unskilled - available on the project  
- Transparent hiring practices and clear information on employment opportunities will help to manage stakeholder expectations |

- TAP AG will enhance national supplier capacity through a comprehensive demand and supply side analysis, phased capacity building program, targeted training agreed with local government, industry and other organisations. (TAP Local Content Strategy (2010) (TAP-HSE-ST-0007))
- The Employment Strategy will outline and require a fair and transparent recruitment process for all openings
- TAP AG will work with local authorities to advertise all openings in ways that are accessible to local communities.
- The Project will provide clear information on the limited number and skills requirements of employment opportunities.

| Economic impacts from taxes (national and local) | MINOR  
- Taxes will generate a long-term (project duration) impact  
- The fees represent a small proportion of government revenue but are a significant sum for a single project.  
- Most economic impact from taxes will accrue at the national level, unless specific provisions are provided to transfer the benefits or target associated spending at a more local level. |

Source: ERM (2012)
8.10.4 Decommissioning Phase

8.10.4.1 Potential Impacts

8.10.4.1.1 Temporary Employment Impacts

The workforce required for decommissioning the pipeline will depend on the approach taken (abandon in place or remove) but is likely to be much smaller than the construction workforce. At this stage, it is thought that decommissioning will require all permanent aboveground elements to be taken down and the sites reinstated (subject to the relevant legislation prevailing at the time of decommissioning). Most of the labour effort will be required at the compressor stations and the 22 block valve stations along the route, although still relatively small (e.g. 150). The duration of time required for decommissioning is unknown at this stage.

8.10.4.1.2 Economic Impacts

Economic impacts during the decommissioning phase will be relatively minimal. There will be a small amount of procurement of goods and services associated with the construction camps near the two compressor stations and some induced economic impact from employee spending.

8.10.4.2 Mitigation Measures

As in the construction phase, TAP AG will undertake a series of mitigation measures in order to optimise national and local level employment opportunities, maintain the integrity of the recruitment process and source goods and services locally. See Section 8.10.2.2 for more detail.
8.10.4.3 Residual Impacts

Table 8-69 Residual Impacts – Economy and Employment – Decommissioning Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decommissioning Phase</td>
<td></td>
<td>(green shading denotes a ‘positive’ residual impact)</td>
</tr>
<tr>
<td>Temporary Employment Opportunities</td>
<td>• TAP AG will enhance national supplier capacity through a comprehensive demand and supply side analysis, phased capacity building program, targeted training agreed with local government, industry and other organisations. (TAP Local Content Strategy (2010) (TAP-HSE-ST-0007))</td>
<td>MINOR • Approximately 70-80% of labour positions will be filled by skilled workers.</td>
</tr>
<tr>
<td></td>
<td>• TAP AG will agree an Employment Strategy with Primary Contractors to outline and require a fair and transparent recruitment process for all openings.</td>
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<td></td>
<td>• The Employment Strategy will require contractors to advertise skilled and unskilled openings thoroughly at the municipal and local level and well in advance of hiring. This will apply to both construction jobs and supporting services. TAP AG will monitor these efforts.</td>
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<tr>
<td></td>
<td>• The Project will provide clear information on the number and limited timescales of employment opportunities.</td>
<td></td>
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<tr>
<td>Temporary economic impact</td>
<td>• TAP AG will enhance national supplier capacity through a comprehensive demand and supply side analysis, phased capacity building program, targeted training agreed with local government, industry and other organisations. (TAP Local Content Strategy (2010) (TAP-HSE-ST-0007))</td>
<td>MINOR • Temporary impact</td>
</tr>
<tr>
<td></td>
<td>• Immediately upon opening a tender the Project (TAP or the Primary Contractor) will make information on tendering opportunities available to local businesses through trade and industry chambers and local business organisations along the pipeline route.</td>
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<tr>
<td></td>
<td>• As part of the tendering process contractors will be required to develop a purchasing strategy that stipulates how national and local purchase of goods and services will be optimised. Agreed targets will be monitored.</td>
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</tr>
</tbody>
</table>

Source: ERM (2012) and ASPROFOS (2013)

8.10.5 Summary of Impacts on Economy, Employment and Income

Construction and Pre-Commissioning Phase:
In general, construction activities for the Project will generate economic benefits from taxes paid by the Project in-country.
The construction workforce for the Project in Greece is estimated at 2,700 for the main construction phase. Most construction employment positions on the Project will be short-term (3-7 months for each pipeline spread and 24 months for each compressor station). Subject to TAP AG’s tendering strategy, it is likely that one or more Engineering, Procurement and Construction (EPC) contractors and a number of local subcontractors will carry out the works. Therefore, the construction workforce will likely compose of both, Greek and non-Greek personnel. Hiring and sourcing of materials will be managed by the primary contractors, who will be required to meet TAP AG’s Corporate Social Responsibility (CSR) requirements set out in the TAP AG policies and the best practice implementation guidance documents of EBRD regarding workers management, accommodation and worker rights.

Construction will require to a large extent a trained and specialized workforce. It is estimated that demand for unskilled labour that could be employed from local or regional labour market along the route is relatively low, estimated around 20 – 30 % of the total construction workforce. TAP AG will encourage contractors to source from local suppliers of goods and services and to provide opportunities for local hiring. In the course of Project preparation, TAP AG’s presently undertaking a Supply Side Analysis for Local Content Development promotes this.

Construction workers will be accommodated in a number of camps that are spread along the route and at the stationary construction sites (currently 8 camps; although additional camps may be established depending on the final number of construction spreads). Camps will be fully serviced, and materials and supplies will likely be sourced at a regional or national level. Populated areas close to construction camps will likely benefit more from employment and local spending impacts than regions that are only passed by the pipeline route. Workers in their free time will likely create more demand in local markets, shops and bars/restaurants during the construction period. However, temporary increase of local business is short term in nature and not anticipated to be in general significant, although it may be higher for settlements in the vicinity of static construction sites such as the compressor stations, due to the longer-term presence of a workforce.

**Operation and Maintenance Phase:**
A general economic benefit for Greece will be taxes during Project operation. The permanent workforce of TAP AG for pipeline system and station operation is estimated to be less than
150 employees; most of these will be highly qualified specialist. In addition, contractors will be involved for facility maintenance and security.

**Decommissioning Phase:**

The workforce required for decommissioning will be likely less than required for construction. Workforce required for pipeline decommissioning depends on the decommissioning approach. If the pipeline is if left in the ground, only a small number will be required, if it is recovered, workforce may be similar as for construction. Beneficial effects on local employment and local businesses cannot be meaningful predicted from today’s perspective but will likely be less than those for construction.

### 8.11 Lands and Livelihoods

#### 8.11.1 Overview

This Section presents the potential impacts to existing livelihoods and land values as a result of project related activity. In addition to the commitments made by TAP AG has committed to complying with the Greek legislation (see Section 3 - Legislative and Policy) and EBRD Performance Standards., A series of mitigation measures have been designed to ensure that the level of impact to social receptors is avoided, minimised or reduced.

The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the TAP Project on land and livelihoods.

**Box 8-10 Key Considerations for Assessment – Land and Livelihoods**

**Sources of Impact/Risk**

- Temporary land-take of approximately 2,145 ha composed of: 2,063 ha for 38 m pipeline working strip; 40 ha for 8 construction camps (5 ha each); 41.8 ha for 17 pipe stockyard areas (1 yard of 6 ha, 1 of 4.5 ha, 3 of 4 ha, 1 of 3.9 ha, 1 of 3.4 ha, 3 of 3.2 ha, 1 of 3 ha, 1 of 2.8 ha, 2 of 2.7 ha, 2 of 2.4 ha, 1 of 2.3 ha, 1 of 2 ha, and 1 of 1.6 ha). Safety zones around construction sites and associated facilities will also be required.

- Permanent land take for two compressor stations requiring up to 36 ha each including safety zones; 22 block valve stations requiring 0.07 ha (total 1.55 ha).
Permanent land restrictions along the 8 m pipeline protection strip (PPS) (total 434.4 ha); pipeline safety zones of up to 40 m (total 2,172 ha) along the pipeline centerline restricting houses and potentially of 400 m (total 21,720 ha) for the construction of new housing clusters and industrial buildings.

Decommissioning: There will be temporary working zones associated with the removal of facilities and infrastructure and restoration of the land.

Potentially Impacted Resources and Receptors
- Owners and users of land affected by temporary land take.
- Owners and users of land affected by permanent land take or land use restrictions.
- Local communities
- Local authorities (regional and municipal/communal).

Particular Baseline Conditions that are Potentially Influencing Impacts/Risks
- In general land use is heavily agricultural;
- Majority of municipalities have a high proportion of low-income households (less than 900 Euro/month).
- Several economic activities undertaken in most surveyed households, however agricultural production is the main economic activity in all regions.
- Intensive permanent crop production is an important livelihood activity particularly in TAP Greece West section (27%-78% of permanent crops are fruit trees).
- Privately owned irrigation systems found in permanent crop production areas along with the seasonal crop areas outside of Serres.
- Generally high levels of land ownership, but with some areas reporting high levels of leaseholders.
- Average total land per household is approximately 3ha -8ha, typically fragmented into several lots.
- High levels of land ownership and land title documentation were recorded throughout study area.
- Land value is influenced by the fact that all land is available for building if property > 0.4ha.
- Pipeline crosses 12 designated development areas in TAP Greece East and 6 in TAP Greece West (see Figure 8-16 to Figure 8-18 below).

Vulnerable Groups
- Households with low income, depending on agriculture as main economic activity (small scale agriculture), owning/using land in the pipeline corridor.
- Farmers who have been adversely affected by past infrastructure projects
- Seasonal migrants (agricultural labourers).

References
- Baseline is found in Section 6.4.5. Impact Assessment Criteria is found in Annex 5.8. Monitoring Measures are described in Section 9.2.

ERM (2012) and ASPROFOS (2013)

The following table presents the key impacts of the TAP Project on land and livelihoods during the key project phases.
Table 8-70  Key Potential Impacts – Land and Livelihoods

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
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<tbody>
<tr>
<td>• Temporary loss of livelihoods and household income</td>
<td>• Permanent loss of livelihoods and household income</td>
<td>• Temporary use of land due to decommissioning activities</td>
</tr>
<tr>
<td>• Displacement of non-residential physical structures</td>
<td>• Changes in land values post construction</td>
<td>• Restoration of land use</td>
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<tr>
<td>• Disturbance to/interruption of permanent crop production</td>
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<td></td>
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<tr>
<td>• Disturbance to animal grazing activities</td>
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<td></td>
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<tr>
<td>• Loss of livelihoods from severance between different land areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Impacts on collection of forest products and animal grazing from site clearing in mountainous areas</td>
<td></td>
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</table>

ERM (2012)

Many of the impacts to land and livelihoods will be experienced throughout the study area and some are specific to locations within the pipeline corridor. Figure 8-16, Figure 8-17 and Figure 8-18 provides a geographic overview of impacts along the pipeline route in relation to land and livelihoods. The maps include areas of seasonal and permanent agriculture and greenhouse, all of which will be temporarily or permanently removed during the construction and operation phases. Additionally, areas where land value change is anticipated due to limitations on development is also illustrated in the figures below.
Figure 8-16  Geographic Overview of Sensitive Land and Livelihood Features along the Pipeline Route of TAP Greece East Section and Potential Impacts (a)

ASPROFOS (2013) – Social field trip 2013
Figure 8-17  Geographic Overview of Sensitive Land and Livelihood Features along the Pipeline Route of TAP Greece East Section and Potential Impacts (b)

ASPROFOS (2013) – Social field trip 2013
8.11.2 Construction and Pre-commissioning Phase

8.11.2.1 Potential Impacts

8.11.2.1.1 Temporary Loss of Livelihoods and Household Income

Land Use

Using available satellite imagery, it is estimated that the 38 m working strip will require the temporary loss of approximately 367 ha of permanent cropland the majority of which will be in TAP Greece West section (353 ha) and is mainly comprised of fruit trees, with some areas of vineyards and olive groves. The working strip will also require 1384 ha of other seasonal or pastoral agricultural land (1,188 ha in TAP Greece East section and 196 ha in TAP Greece West...
section) and 146 ha of forests (52 ha in TAP East section and 94 ha in TAP West section). In addition to the working strip, there will be a total of 8 construction camps and 17 pipe yards located approximately every 40 km along the pipeline corridor and requiring a total of 41.8 ha. All construction camps are located in areas of seasonal agricultural use or areas of fallow land. Block valve stations will be established within the working strip and road construction will focus on the upgrading of existing routes.

With the exception of areas of difficult terrain in mountainous regions, construction will be completed and land reinstated within a calendar year. Consequently the loss of seasonal agricultural production will predominantly be over a one-year period. The re-establishment of land productivity to the level prior to construction may take time, with permanent crop production taking longer to re-establish (olive and fruit trees take between 3 and 5 years to produce fruit and 6 to 10 years to reach full production; vines take up to 5 years to become re-established and reach full production).

As shown in Figure 8-19 and Figure 8-20 for the majority of the settlements in the social study area, the proportion of agricultural land affected by the 38 m construction strip related to the total active agricultural land is generally less than 10%\(^54\). The exception is Aspron in Skydra municipality (Central Macedonia)\(^55\) where slightly more than 10% of the settlement’s active agricultural land will be affected during construction. This is part of a larger area between KP401 and KP425.2 (Pella, Skydra, Naousa and Edessa municipalities in Central Macedonia – refer to route maps in Annex 3.3) where nearly 100% of the pipeline working strip crosses orchards. The level of impact due to loss of permanent crop production is likely to be greater in this area, as these crops form an important source of household income and restoration of full production levels in these areas will take several years. The relatively high level of crop loss in Aspron may result in secondary impact to those within the marketing chain of agricultural products. As animal husbandry and small industry were also reported as important economic activity for Aspron, impacts to the general settlement economy due to a reduced level of income into the settlement are less likely.

\(^54\) Agricultural lands in the 38m strip in Kleisoura (20.5%) – Kastoria municipality and Grammatikon (10.5%) – Edessa municipality, are pastures and healthlands used for the grazing of livestock.

\(^55\) It is noted that land lots of local communities along the route which are not located within the pipeline corridor of the social study area may extend to the pipeline route and may therefore have land located within the study corridor. They have not been consulted and. will be addressed within the forthcoming stakeholder engagement activities (as per SEP, cf. Section 7). Regardless, the Land and Easement and Acquisition leaflet, as well as the Draft Livelihood Restoration Framework state that all affected landowners will have to be identified and consulted in the context of provision of mitigation measures. This process will also include all affected landowners, even if their communities are located outside the social study area.
Figure 8-19  Share (%) of Settlement Active Agricultural Land in 38 m Construction Strip in TAP East Section

Source: Hellenic Statistical authority, Agricultural and Farming Census, 2000
As shown Figure 8-21 loss of active agricultural land in other settlements in TAP Greece West with a high permanent crop production is less than 10%. Stakeholder concerns expressed during community meetings reflect the importance of permanent crop production for this part of the pipeline route – the loss of livelihood and land compensation were of particular concern in Pella, Skydra, Naousa and Eordea.

In TAP Greece East, the total area of permanent crop production within the working strip accounts for less than 1% The level of impact due to loss of permanent loss production is thus likely to be significantly lower in the TAP Greece East section of the route.
At a household level, the level of impact from temporary loss of land will be determined not only by the proportion of land lost by individual households, but also by their level of dependence on the land, access to alternative livelihood activities and their current level of income. Along the route, households generally have diverse sources of income, but agriculture is a main economic activity in East and Central Macedonia, reducing in importance along the route in West Macedonia, where other sources of income have more importance. There is likely to be limited access to alternative livelihood activities due to unemployment rates that are higher than the national average.

As mentioned in Section 8.10.2.1.1, women rarely have access to an independent income source and their participation in the workforce is bound to their home. However, women are not generally considered a vulnerable group as they (1) have equal legislative rights to land; (2) they often have control over the household income and (3) they rarely work in agricultural production outside of their household. To ensure women have equal access to project information, TAP AG will continue to engage directly with women throughout all project phases.
Households with little access to alternative livelihood and/or on a low income are considered vulnerable as they will experience a greater level of impact than those with higher income and access to alternative resources, including savings. This will especially apply to households which rely on small scale farming with small plot sizes, where land take during construction could affect all the land available to a household. Loss of livelihood for smallholders was raised as a particular concern in community meetings in Alexandroupoli, Eordea and Skydra municipalities, where the pipeline crosses smallholder areas (irrigated annual crops in Alexandroupoli around KP0.0 to KP13.0 and Eordea around KP471.9 - 474.9 and KP 482.9 - 484.9; fruit tree plantations in Skydra around KP413 - 421.2 – refer to route maps in Annex 3.3). Stakeholder voices from the three municipalities reflect this situation:

- I have a small piece of land. If you pass through, my field and crop will be useless. (Alexandroupoli municipality)
- In this area, most of the land consists of small plots - if you pass through this, you will be destroying all of our land; make it unusable. (Skydra municipality)
- The pipeline will destroy and reduce the value of the land. The plots are relative small so the restrictions may result in problems regarding the use of land (either for farming or for construction. (Skydra municipality)
- What if a person has one plot of land? You are taking away all their land. How are you going to compensate them? (Eordea municipality)

Landowners that have already been impacted by past infrastructure projects are particularly sensitive to project impacts to land and crop production. The number of landowners that will be affected by both projects will not be known until TAP undertakes the land and easement process, however, during the Greece East consultation process this was raised as a concern by participants The Project will need to build trust with these stakeholders through the continued engagement process, compensation and the use of construction management practices. The level of impact experienced by this group during construction is likely to be minor through the use of these mitigation measures.

In some instances land may be orphaned during the construction phase. Orphan land is when a section of a plot becomes too small to be economically viable for agricultural production and/or cannot be accessed during construction. In most cases these small sections are located either side of the construction corridor. Whether a parcel qualifies as orphan land will be reviewed by TAP AG on a case by case basis.
Land Tenure
Land ownership is generally high throughout the social study area and the majority of residents have land title documents. The only settlement reporting not having access to title documents was in the settlement of Fylakas (municipality of Komotini). Lack of land title documents was raised as a concern in relation to how the Project will deal with this when identifying landowners during the land and easement process. It was reported during community meetings that obtaining title deeds would require a lot of money, as the new title owners will have to pay 11% of the land’s nominal value over 20 years, which is something they cannot afford.

Land rights were also raised as an issue in Maronia-Sapes municipality (East Macedonia-Thrace) in relation to access to subsidies. A large proportion of farmers in Greece receive annual subsidies from the EU to assist them with crop production and in Greece East 57 of the 63 surveyed settlements (90%) reported receiving EU subsidies. During consultation, farmers stated that they had experienced problems during construction of past infrastructure projects, which had led to them losing their land rights and farming subsidies due to non-crop production to more than 12 month period:

“During the years 2000, 2001, 2002 each landowner’s rights were determined. These rights are provided to each landowner by the Greek competent organisation for agricultural subsidies. In case a farmer doesn’t grow crops for a year they lose forever the agricultural rights on this particular piece of land. In some cases, during the previous pipeline construction, some machinery ruined a piece of a field, the crops were damaged, and the landowner lost the right to that specific piece. We didn't grow cotton on the work corridor during construction and we lost subsidies of this land for ever”. (Amaranta, Maronia-Sapes municipality).

The LEA process is investigating whether loss of farming land during construction will have an impact on these subsidies. Any changes to land rights or subsidies in the long term as a result of construction will impact numerous households throughout the social study area.

Loss of land has the potential to not only affect the livelihoods of farming land owners, but also those renting agricultural land. The level of leaseholders\(^56\) in the social study area is high with more than 50% of the total land holdings in 39 local settlements in the pipeline corridor\(^57\), which accounts to approximately 40% of the total settlement number (see Figure 8-22 and Figure 8-23).

\(^{56}\) All reference to leaseholders includes rights-holders and usufruct users.
\(^{57}\) Pipeline corridor in TAP Greece East is 1 km where the pipeline runs parallel to the existing national gas pipeline and 2 km where the pipeline deviates from the existing national gas pipeline. Pipeline corridor in TAP Greece West is 2 km along the whole route.
Leaseholders, as well as land owners, will potentially experience temporary loss of income and loss of livelihood during construction.

**Figure 8-22** Leaseholders in the Study Area per Total Land Holdings in the pipeline corridor TAP Greece East Section

Source: Hellenic Statistical Authority, Census of Agriculture and Farming, 2000
In Emmanouil Papa and Erdoea Municipalities, leaseholders expressed concerns during community meetings related to the fear that they might not be considered in the context of mitigation as they possess no legal land title.

**Seasonal Labourers**

Seasonal agricultural labourers may experience a temporary loss of income in the context of a reduction in agricultural production during construction. Seasonal use of agricultural labour is found in the areas of permanent crop production in TAP Greece West and in some seasonal crop areas in TAP Greece East. A large proportion of this labour is formed of temporary Albanian and Bulgarian migrants who come to Greece to work during key points in the farming calendar such as the summer months and during harvesting. Some people return to the same farms each year whereas others travel around looking for casual work. These groups are vulnerable as they often have less access to information or utilities and employment is often unsecured. They are more likely to be employed based on basic contracts or cash payment, which offer limited labour rights. Due to the nature of their employment and temporary residence in Greece accessing this group during the consultation process has been difficult. It is not clear the number of seasonal migrants
that will be impacted by changes in seasonal and permanent crop production or if they will be able to find alternative work; therefore the scale of impact to this group is unclear.

8.11.2.1.2 Displacement of Non-Residential Physical Structures

Physical structures within the 38 m working strip will have to be removed before the start of construction. Within the future safety zone of 40 m (20 m either side of the centreline), physical structures will be restricted to greenhouses and pump houses for irrigation. In the event that a residential building is identified within the 38 m working strip, a micro re-routing will be undertaken.

Within the working strip there are only two areas with greenhouses, one close to Krinos (2 greenhouses) in the municipality of Serres and one close to Aspron (3 greenhouses) in the municipality of Skydra, which will be removed temporarily for construction where no minor re-routes to avoid impact are feasible. Greenhouse owners and their employees will experience a temporary loss of income and employment during construction. The level of potential impact from the physical displacement of greenhouses will depend on the number of people temporarily losing income or losing employment, access to alternative employment and access to alternative income sources. There is a lack of employment opportunities throughout the social study area, so employees may struggle to find alternative employment in the local area.

In TAP Greece West, pump houses for irrigation crossed by the pipeline are apparent in the municipalities of Pella and Skydra, along the settlements of Agios Loukas, Liparo, Aspro, Kalivia, Petrea, Rizon, Loutrochori and Polla Nera and in the municipalities of Kastoria and Orestina in the settlements of Korissos and Militsa. In TAP Greece East there are only two areas with pump houses within the working strip, two pump houses close to Pamforo and one in Meleti. Disruption to private irrigation systems has the potential to reduce the income to the farmers.

High resolution satellite imagery and on the ground verification shows other physical structures within the 38 m construction strip and/or the 40 m safety zone. These structures are mainly agricultural buildings, such as large barns or animal shelters, all of which are located in relatively isolated agricultural areas. There are no residential buildings in critical distance to the centreline. For each of the remaining non-residential structures, the Project will investigate possibilities for
minor re-routes to bring the structure outside the 40m safety zone. Should this not be possible, the structure will need to be dismantled and removed. The locations of the abovementioned structures are presented in Table 8-71.

### Table 8-71: Physical Structures within the 38 m Construction Strip and / or 40 m Safety Zone

<table>
<thead>
<tr>
<th>KP</th>
<th>Closest Settlements</th>
<th>Type of Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>42.28</td>
<td>Amfitriti</td>
<td>Small size warehouse, isolated in agricultural area</td>
</tr>
<tr>
<td>42.26</td>
<td>Amfitriti</td>
<td>Small size warehouse, isolated in agricultural area</td>
</tr>
<tr>
<td>60.1</td>
<td>Atarni</td>
<td>Medium size agricultural structure, isolated in agricultural area</td>
</tr>
<tr>
<td>82.2</td>
<td>Pamforo</td>
<td>Small non-residential structure, isolated in agricultural area</td>
</tr>
<tr>
<td>82.2</td>
<td>Pamforo</td>
<td>Medium non-residential structure, isolated in agricultural area</td>
</tr>
<tr>
<td>135.1</td>
<td>Vafeika</td>
<td>Small size warehouse, isolated in agricultural area</td>
</tr>
<tr>
<td>141</td>
<td>Magiko</td>
<td>Small size container, isolated in agricultural area</td>
</tr>
<tr>
<td>150</td>
<td>Pimni</td>
<td>Medium non-residential structure, isolated in agricultural area</td>
</tr>
<tr>
<td>178.33</td>
<td>Nea Karvali</td>
<td>Telephone communication antennas, isolated in agricultural area</td>
</tr>
<tr>
<td>188.8</td>
<td>Prosfyges</td>
<td>Medium size agricultural structure, isolated in agricultural area</td>
</tr>
<tr>
<td>255.2</td>
<td>Nea Zichni</td>
<td>Medium size agricultural structure, isolated in agricultural area</td>
</tr>
<tr>
<td>249.4</td>
<td>Gazoros</td>
<td>Medium size warehouse</td>
</tr>
<tr>
<td>279.14</td>
<td>Mitrousi</td>
<td>Medium size warehouse, isolated in agricultural area</td>
</tr>
<tr>
<td>458</td>
<td>Antigonus</td>
<td>Isolated rural structure</td>
</tr>
<tr>
<td>492.5</td>
<td>Kleioura</td>
<td>Small building, isolated in agricultural area</td>
</tr>
<tr>
<td>498.95</td>
<td>Agia Paraskevi</td>
<td>Agricultural structure</td>
</tr>
<tr>
<td>506.4</td>
<td>Korissos</td>
<td>Small agricultural structure, isolated in agricultural area</td>
</tr>
<tr>
<td>508.25</td>
<td></td>
<td>Small warehouse, isolated in agricultural area</td>
</tr>
<tr>
<td>534</td>
<td>Oinois</td>
<td>Small agricultural structure, isolated in agricultural area</td>
</tr>
</tbody>
</table>

*Source: ERM (2012) and ASPROFOS (2013)*

### 8.11.2.1.3 Disturbance to Animal Grazing Activities

Impacts to animal grazing activities during the construction phase, result from farmers having restricted access to grazing land and/or farmers being temporarily unable to access grazing land due to the working strip. The working strip currently crosses 81 ha of grazing land with the largest proportion (17 ha) found in Amyntaio municipality (West Macedonia) followed by Lagada and Eordea, both of which are in Central Macedonia (12 ha each). Animal grazing is usually
undertaken over a wide area; therefore farmers with restricted access to grazing land temporarily occupied by the working strip will find alternative land in most instances in nearby areas. Farmers that are severed from their grazing land may have to walk long distances around the working strip, which will disrupt existing farming practices.

8.11.2.1.4 Loss of Livelihoods due to Severance

As the Project progresses, the working strip will pass between settlements and through agricultural areas. Main roads will remain open during the construction phase, but the working strip will temporarily sever tracks and farm trails between fields linking different land plots. This may result in farmers having to travel longer distances to access their fields.

The length of time farmers are severed from their land varies depending on the terrain and the length of time it takes to excavate the trench, lay the pipeline and backfill. In most cases the trench will only be open for a number of days, but in exceptional cases, where terrain is difficult, the trench may be open for 1-2 months.

8.11.2.1.5 Collection of Forest Products from Site Clearing and Opening Access Roads in Mountainous Areas

The Project would require vegetation clearance for preparation of the working strip and opening of any new access roads. In forests and forested areas this could result in significant amount of timber (firewoods or industrial). The level of forest clearance required during the construction phase varies between municipalities, but in total 146 ha of forest will be cleared which accounts for 15% of all land use within the working strip. The largest area of forest clearance will be in Edessa Municipality where 55.5 ha of forest will be cleared, which accounts for more than 80% of all land uses within the working strip in the municipality. The second largest area of forest clearance will be in Alexandroupoli municipality where maximum 31.6 ha of forest will be cleared, accounting for approximately 62% of all land uses within the working strip in the municipality. In Kastoria Municipality, 27 ha of forest will be cleared, making up approximately 20% of all land uses within the working strip. The level of potential impact from site clearing will

58 The size of 31.6 ha includes the 8 m permanent protection zone of DESFA pipeline
not only depend on the area of forest which will be cleared but also on the importance of logging as source of income for affected households, the current overall level of household income and on access to alternative livelihood activities and/or access to alternative forest areas for logging.

Forests are used for commercial logging in a number of settlements where it was reported as an important economic activity. Forests are also informally used by individual households for firewood collection. Firewood is predominantly collected for personal consumption, except in one municipality where more than 50% of all wood collected is sold. In some areas along the route the government has granted tracts of forest to low-income families and pensioners to meet their firewood needs. The affected areas are all located within large forested areas so it is expected that the impact to logging operations and informal wood collection is likely to be minor.

8.11.2.2 Mitigation Measures

TAP AG has developed a *Land and Easement Acquisition Strategy (TAP-HSE-ST-0002)*, which commits TAP AG to mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons’ use of or access to land. There are several key elements to this mitigation approach including:

- Providing compensation for loss of assets at replacement cost;
- Ensuring that displacement of economic activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected;
- Improving or, at a minimum, restoring the livelihoods and standards of living of displaced persons to pre-Project levels, so as to facilitate sustainable improvements to socioeconomic status; and
- Paying particular attention to the needs of vulnerable groups.

In order to realise these objectives, the Project has established a *Livelihoods Restoration Framework (LRF)* in line with the EBRD Performance Requirements, an overview of which is provided in the box below.
Box 8-11 Overview of Livelihoods Restoration Framework

The LRF establishes the entitlements of affected persons or communities and ensures that compensation is provided in a transparent, consistent, and equitable manner. In line with the EBRD requirements the LRF will include the following:

- A detailed and comprehensive description of the project and all its components and associated facilities, including the land/easement to be acquired.
- A description of the legal framework and legal and customary procedures of private land/easement acquisitions.
- A description of measures taken to avoid physical displacements and to minimise economic displacements.
- A comprehensive assessment of the impacts of the economic displacement
- An entitlement matrix, defining for each of the identified losses the compensation needed to assure that livelihoods and standards of living of all affected people are restored to levels they will have achieved in a non-TAP scenario and that the living conditions and livelihoods of vulnerable groups are improved.
- A description of mechanisms for addressing grievances, complaints and appeals taking into account the availability of judicial recourse as well as traditional conflict resolution mechanisms.
- An outline of the monitoring, which will be conducted by TAP AG as well as by independent evaluators to ensure that complete and objective information are available for the participatory performance monitoring system.

A summary of the LRF must be available to the public to ensure that affected people understand the compensation procedures and know what to expect at the various stages of the project.

The LRF will also:

- Provide opportunities to economically displaced persons and communities
- Promptly compensate economically displaced persons for loss of assets or access to assets at full replacement cost.

Once the LRF is finalised a Guidance Leaflet on Acquisition and Compensation (GLAC) will be developed, which summarises the key elements of the LRF, including the type of impact from land and easement acquisition and provides guidance on how stakeholders should be compensated. This document also draws on principles outlined in several policy documents including: TAP AG’s Policy on Corporate Social Responsibility (TAP-HSE-PO-0002), the Land and Easement Acquisition Strategy (TAP-HSE-ST-0002) and the Draft Land Access Plan (TAP-HSE-MO-0004). The GLAC, as well as the Policy documents, serve as reference for the description of mitigation measures in the paragraphs below.

8.11.2.2.1 Temporary Loss of Livelihoods and Household Income

- TAP AG will begin identifying individual landowners as soon as possible. The project will also make an effort to identify absent landowners and those without land title documents.
Individual forest owners/formal forest users and /or forest associations will be integrated into this process.

- In accordance with the LRF, landowners that are not in possession of official land title will be assisted by the Project in securing these documents.

- A reduced working strip (28 m) will be implemented as required (and technically feasible) through forested areas, in order to minimize impacts (refer to Section 8.7.2.1.1 for habitat loss calculations associated with construction).

- Affected landowners and/or rights-holders\(^{59}\) are entitled to compensation at replacement value for the lost income opportunities i.e. the revenue the land could have produced.

- Affected land and asset owners are entitled to the restoration of all assets to its pre-project condition and/or the total costs to restore all damaged assets to pre-Project conditions.

- Affected landowners and/or rights-holders are entitled to compensation for reduced income during the recovery period.

- Prior to commencing preparations for the construction phase TAP AG will investigate possibilities for minor re-routes in smallholder areas in order to minimize impacts on vulnerable households (i.e. avoid cutting through areas of small plots, utilising agricultural roads or plot boundaries instead).

- Land owners will receive timely and clear information on timing of construction works in the course of community liaison activities so that they become fully aware of the exact time for start of construction and of the duration of interruption of agricultural activities.

- Compensation for orphan land, once recognised, will be based on the same entitlements as the main affected piece of land.

- TAP will be sensitive to the additional concerns of landowners that have previously been affected by past infrastructure projects and will ensure that they are provided with information on how the Project will address these concerns.

- TAP will identify farmers receiving agricultural subsidies during the Land and Easement process TAP will fully compensate these farmers in the event of loss of subsidies during the construction phase.

- Affected agricultural workers including seasonal migrants will be entitled to compensation for temporary loss of income. The Project will work with local authorities, community groups and farmers to understand how this group can be included in the engagement and compensation process.

\(^{59}\) Rights-holders include leaseholders and usufruct land users.
8.11.2.2.2 Displacement of Physical Structures

- Minor re-routings will be conducted where possible to avoid removal of greenhouses and irrigation pump houses.

- The Project will investigate possibilities for minor re-routes to bring structures outside the 40m safety zone. Should this not be possible, the structure will need to be dismantled and removed.

- The project will provide compensation to the owners of greenhouses for loss of earnings and cost of rebuilding a replacement structure, and will additionally compensate employees working in the greenhouse for any temporary loss of earnings.

- Affected owners of any properties or agricultural buildings that need to be removed will be compensated at full replacement cost.

- Through stakeholder engagement and public disclosure it will be communicated to affected communities along the route that restrictions will apply to building activities in a 40 m corridor for safety reasons.

8.11.2.2.3 Disturbance to Animal Grazing Activities

TAP AG will consult with local farmers engaging animal grazing activities to identify the appropriate number and location of animal crossings. TAP AG will ensure that this information is included in the ESMMP for implementation by the contractor.

8.11.2.2.4 Loss of Livelihoods due to Severance

- In rural areas crossings over the pipeline construction area will be provided where possible to avoid any impacts associated with severance to grazing or agricultural land. The location of such crossings will be agreed between the contractor and local farmers as part of the consultation on the construction management plan. TAP AG will ensure that clauses are included in contractor agreements to ensure that this is carried out where necessary. Where crossings are not possible and farmers will experience a loss of grazing or additional journey times during the construction period, compensation will be provided.

- When access roads are blocked during construction the Project will establish alternative routes to allow those affected to access fields and other places of work. Should this not be
possible for any reason, this will be agreed with users and compensation provided if required.

8.11.2.2.5 Collection of Forest Products from Site Clearing and Opening Access Roads in Mountainous Areas

- In forest areas the construction strip width will be reduced to 28 m.
- TAP AG will engage authorities to identify alternative sites for authorised users when areas currently used for collection of firewood are restricted or cleared due to project activities.
- When accessing government’s land, TAP AG will engage with authorities to manage distribution of collected project products, i.e. timber.
- TAP AG will pay special consideration to vulnerable groups losing access to firewood collection.
- Deliver information sheets to neighbouring communities to inform them in advance of restricted access to forest areas.
8.11.2.3 Residual Impacts

Table 8-72 Residual Impacts – Lands and Livelihoods – Construction Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary Loss of Livelihoods and Household Income</td>
<td>Livelihoods Restoration Framework</td>
<td>MODERATE</td>
</tr>
<tr>
<td></td>
<td>• TAP AG to identify land owners and land users (e.g. leaseholders) within the pipeline corridor, The Project will also make an effort to identify absent landowners.</td>
<td>• Changes to land will impact 1,000’s of landowners and users.</td>
</tr>
<tr>
<td></td>
<td>• Affected land owners or users will be compensated for temporary loss of access rights, for any structures or developments on land that the land owner or land user can demonstrate ownership of; (and any standing annual or perennial crops at the replacement value. In line with LEA procedures TAP will provide compensation prior to construction.</td>
<td>• Impacted households located along the length of the pipeline corridor.</td>
</tr>
<tr>
<td></td>
<td>• Affected landowners and/or rights-holders are entitled to compensation at replacement value for the lost income opportunities and for reduced income during the recovery period.</td>
<td>• Impacts to land will, at best, cause a disruption to livelihood activities.</td>
</tr>
<tr>
<td></td>
<td>• Affected land and asset owners are entitled to the restoration of all assets to its pre-project condition and/or the total costs to restore all damaged assets to pre-project conditions;</td>
<td>• Impacts experienced in the short term by seasonal crop owners. Permanent crop holders will be affected in the medium-term until trees re-establish.</td>
</tr>
<tr>
<td></td>
<td>• Compensation for orphan land, once recognised, will be based on the same entitlements as the main affected piece of land.</td>
<td>• Number of landowners previously impacted by past infrastructure projects who will be affected by this Project is unclear. Impacts to this group likely to be the same as all other landowners, however, this group are particularly sensitive to land and livelihood changes.</td>
</tr>
<tr>
<td></td>
<td>• TAP will be sensitive to the additional concerns of landowners that have previously been affected by the past infrastructure projects and will ensure that they are provided with information on how the Project will address these concerns.</td>
<td>• Affected agricultural workers including seasonal migrants are entitled to compensation for temporary loss of income and the Project will work with authorities, community groups and farmers to identify affected individuals and groups.</td>
</tr>
<tr>
<td></td>
<td>• TAP will compensate for any temporary loss of agricultural subsidies as a result of Project.</td>
<td>• To ensure women have equal access to project information, TAP AG will continue to engage directly with women throughout all project phases.</td>
</tr>
</tbody>
</table>
### Impact / Risk Measures to Address the Impact / Risk Significance of Residual Impact / Risk

#### Land and Livelihoods

<table>
<thead>
<tr>
<th>Land and Livelihoods</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| Displacement of physical structures | - Compensate greenhouse owner/owners for loss of earnings and cost of replacement structure.  
- Workers will be compensated for temporary loss of earnings  
- Route optimization in order to avoid displacement of physical structures which are located within the construction strip/the safety zone;  
-Affected owners of any properties that need to be removed will be compensated at full replacement cost  
-Through stakeholder engagement and public disclosure it will be communicated to affected communities along the route that restrictions will apply to building activities in a 40 m corridor for safety reasons. | MINOR  
- Avoidance of physical structures to be removed in construction corridor, in case structures have to be dismantled, compensation will cover full replacement costs  
- Impacts experienced in the short term for greenhouse owners and agricultural workers. |
| Disturbance to animal grazing activities | - TAP AG will consult with local farmers engaging animal grazing activities to identify the appropriate number and location of animal crossings. TAP AG will ensure that this information is included in the ESMMP for implementation by the contractor. | MINOR  
- Short-term inconvenience to people engaged in animal husbandry.  
- Short-term impact to livelihoods |
| Loss of livelihoods due to Severance | - Contractual clauses to ensure that contractors consult with local farmers to establish the appropriate number and location of animal crossings as well as crossings used for machinery.  
- Provide alternative access routes when roads are blocked during construction. | MINOR  
- Short-term inconvenience to households and individuals. |
| Impacts on collection of forest products from site clearing and opening access roads in mountainous areas | - Reduction of width of construction strip in forest areas (28 m)  
- Engage with authorities to identify alternative sites for authorised users when areas currently used for collection of firewood are restricted or cleared due to project activities, special consideration of vulnerable groups losing access to firewood collection.  
- Engage with authorities to manage distribution of collected products due to project activities, i.e. timber.  
- Deliver information sheets to neighbouring communities of restricted forest areas to inform them in advance of restricted access. | MINOR  
- Minor disruption to the collection of firewood. |

ERM (2012) and ASPROFOS (2013)
8.11.3 Operation and Maintenance Phase

8.11.3.1 Potential Impacts

8.11.3.1.1 Permanent Loss of Livelihoods and Household Income due to Changes to Land Uses in Areas of Permanent Crop Production

Satellite imagery and groundtruthing shows that the majority of permanent crop production is in the TAP Greece West section of the Project, which is where approximately 8.7 ha of fruit trees that will be permanently removed for the 8 m pipeline protection strip. The greatest loss of permanent crops will be experienced in Skydra (5 ha), followed by Naousa (2.5 ha). Losses in Edessa and Amyntaio municipalities account for about 0.5 ha respectively. In TAP Greece East a total of approximately 3.0 ha of mainly olive trees will be permanently removed for the 8 m protection strip, mainly around Nestos and Kavala (0.6 ha). The compressor stations will result in a permanent land take of up to 72 ha of agricultural land, which mainly comprises seasonal crops.

At this stage it is not clear how many different landowners and users will be affected or the proportion of household livelihood and income this represents. This information will only be available once the Land and Easement team have confirmed all property ownership and updated cadastre information throughout the pipeline corridor.

The impact from the loss of permanent crops will largely depend on the proportion of crops lost per household and the proportion that can be replanted. Baseline data shows that in some areas, especially in Skydra municipality, land parcels of permanent crops are small (0.5 ha), which means there is the potential for farmers to permanently lose a large portion of their permanent crop land, resulting in a long-term impact to household livelihood and income.

**Figure 8-24** below presents an estimate of the proportion of the area of fruit tree plantations that will be permanently lost per affected local settlement in the social study area as a result of the 8m permanent protection strip. As shown settlement level losses are low (below 1%), with Aspron in Skydra municipality with a higher loss at approximately 2.2 % of total active agricultural land pertaining to the settlement. Overall, impacts are expected to accrue at the household, and not
the settlement level. Special consideration will have to be given to households that will lose a large percentage of their permanent crop land area.

**Figure 8-24** Share (%) of Active Agricultural Land in 8 m Pipeline Protection Strip for Settlements with High Permanent Crop Production

![Graph showing percentage of active agricultural land in 8 m Pipeline Protection Strip for settlements with high permanent crop production.](image)

Source: ERM; Hellenic Statistical Authority, Census of Agriculture and Farming, 2000

The impact to permanent crops and respective compensation is of high concern to affected communities:

- We will not let you pass, we have tree plantations here and you are going to destroy everything. We are making our living from the tree plantations. – Settlement meeting in Rizon (Skydra municipality, Central Macedonia);
- Will compensation be paid for just one year? We have tree crops that could cost us income for many years. – Settlement meeting in Plevroma (Skydra municipality, Central Macedonia);
- Production of fruit starts 5 years after planting - will this be taken into account in compensation? – Settlement meeting in Liparon (Pella municipality, Central Macedonia).
About 32 ha of forests will be permanently removed for the 8m protection strip (12 ha in TAP East section and 20 ha in TAP West section). The affected forest areas are largest in Flamouris and Grammatikon (in Edessa municipality) with 6.8 and 4.9 ha respectively; Pefka and Aetochori (in Alexandroupoli municipality) with 4.8 ha, Kleisoura 2.7 ha; Oinis 2.8 ha; and 4 other settlements with less than 1 ha. Given the size of the remaining forest areas, this loss is likely to be easily compensated for.

8.11.3.1.2 Changes in Land Values post Construction

Impacts from changes to land values post construction will vary depending on current and future land use. The majority of land within the 8m pipeline protection strip is rural, with 251 ha (about 86%) in TAP Greece East and 115 ha (about 80% of land) in TAP Greece West currently used for some form of agricultural production. However, the value of this land varies depending on several factors including location, soil quality, access to irrigation and, importantly, the ability to construct on the land.

The pipeline may affect land prices in three ways. Firstly, the construction of the pipeline may affect the productivity of the land; secondly there will be restrictions to the planting of permanent crops in the pipeline protection zone, and thirdly there will be restrictions to the construction of new buildings or structures. The first two of these items is considered in previous Sections. With regard to restrictions to building, health and safety requirements do not allow construction of new individual houses or buildings within the inner safety zone (20 m either side of the centreline). In addition, TAP is negotiating with the Greek government to restrict the development of clusters of buildings within an enlarged safety zone (up to 200 m either side of the centreline).

With the exception of specifically protected areas and urban control zones, Greek zoning laws enable any landowner with a plot of land greater than 4,000m² to build a structure (residential or industrial) on that site. However, upon Project construction, local landowners within the safety zones will be prohibited from building on their land for personal use and the price of the land will also be affected. Such changes in land values, loss of opportunities and respective compensation were major stakeholder concerns along the route:
When a field is crossed in the middle by the pipeline, then it is useless, you cannot build on it. (Avdira municipality, Eastern Macedonia-Thrace)

The fields are lost, we can’t build or plant trees. (Nestos municipality, Eastern Macedonia-Thrace)

Our fields and crops become useless. We cannot build, but also cannot use the land to plant tree crops (Kavala municipality, Eastern Macedonia-Thrace)

People have buildings within the enlarged safety zone (200 m either side of the centreline) - how will this be taken into account? Or we may want to build in this area - including industrial use. (Skydra municipality, Central Macedonia)

The pipeline will destroy and reduce the value of the land. The plots are relative small so the restrictions may result in problems regarding the use of land (either for farming or for construction). TAP AG should buy the land or should reduce the length of the safety corridor (Skydra municipality, Central Macedonia).

Who will impose the restriction for construction of buildings in the safety zone corridors? Is the state going to give compensation for the depreciation of the land value from the land restrictions? Valtochorion (Chalkidona municipality, Central Macedonia).

People may want to build on the road between Aspro and Liparon - the building restrictions will have an impact on the value of their property. Will we be compensated? – Liparon (Pella municipality, Central Macedonia).

What if we own plots greater than 4,000 m² in the enlarged safety zone corridor. We may want to sell this land for industrial development. This is a significant opportunity cost for us. Liparon (Pella municipality, Central Macedonia).

What will happen to my land in the safety zone corridors? It will be dead land because I won't be able to use my land, plant trees or construct a storage house. I won't be able to sell my land because it will have no value. – Droseron (Eordea municipality, Western Macedonia).

Landowners who have already been impacted by past infrastructure projects, were particularly concerned about the further restrictions that could potentially be placed on their land. The loss of land value will depend on the size of the affected land parcel, its location and current use, plus the distance to other villages and larger centres. The number of landowners who will be impacted by this will not be clear until the land and easement process is underway.
The enlarged safety zone restrictions that TAP intends to implement could also impact regional/local development planning, which are the responsibility of the local municipality authorities. Specific proposed developments that may be affected are as follows:

- Municipality of Alexandroupoli
  - Amfitriti: waste water treatment plant;

- Municipality of Maronia-Sapes
  - Chamilo: new train line and a biological treatment plant;

- Municipality of Komotini
  - Kosmio: teaching and living facilities for people with disabilities;

- Municipality of Iasmos
  - Galini: sewage network system;
  - Iasmos: power transmission line 150kV

- Municipality of Avdira
  - Vafeika: management of Kosynthos river

- Municipality of Kavala
  - Nea Karvali: new train line

- Municipality of Emmanouil Papa
  - Neochori: irrigation system

- Municipality of Lachana
  - Karteres: power transmission line 400kV

- Municipality of Lagada
  - Assiros: main road

- Municipality of Chalkidona
  - Gefira: planned urban expansion area

- Municipality of Skydra
  - Petrea: designated industrial area
• Municipality of Eordea
  o Perdikkas: waste water treatment plant;
  o Ptolemaidos: waste water treatment plant;
  o Drosero: waste water treatment plant.

• Municipality of Mourikios
  o Foufas: dam for irrigation.

• Municipality of Kastoria
  o Mavrochorio: land bank policy area;
  o Tsakoni: sewage system; and
  o Kleisoura: community forest, used for recreation and planned for eco-tourism development.

• Municipality of Agia Triada
  o Chiliodendro: sewage system.

8.11.3.2 Mitigation Measures

The LRF, GLAC and other TAP AG policy documents outlined above have been designed to address impacts resulting from changes to land and livelihoods. These documents specifically address mitigation of impacts during the operation phase and are presented below.

8.11.3.2.1 Permanent Loss of Livelihoods and Household Income due to Changes to Land Uses in Areas of Permanent Crop Production

• Affected land owners and/or right holders are entitled to cash compensation at replacement values for the loss of income opportunities from permanent crops, i.e. the difference between the yield generated by the former land use and the land use allowed with the restrictions in place.

• Affected landowners are entitled to compensation at replacement values (market value + transaction fees) for their lost lands i.e. the costs to identify and purchase similar or better land of identical size in a similar location.
• Affected landowners and/or right holders are entitled to cash compensation at replacement values for the reduced opportunities to use the land most productively (lost stumpage value).

• Affected rights-holders are entitled to compensation at replacement values for their lost rights. The compensation may be used so that the affected landowner can purchase similar or better land.

• Affected asset owners (structures and improvements) are entitled to compensation at replacement values for these assets i.e. the costs to identify and purchase or establish similar or better assets on similar or better land nearby.

8.11.3.2.2 Changes in Land Values Post Construction

• Systematic engagement with local authorities in order to cover the entire range and all levels of local and regional planning which will be affected by the Project. This engagement will result in either re-routings or change on the development plans.

• Affected land owners and/or right holders are entitled to cash compensation at replacement values for the reduced opportunities to use the land most productively (lost stumpage value).

• TAP is conducting an independent and comprehensive study on compensation values, to address potentially reduced land values.
8.11.3.3 Residual Impacts

Table 8-73 Residual Impacts – Lands and Livelihoods – Operation Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| Permanent loss of livelihoods and household income due to changes to land uses in areas of permanent crop production. | Livelihoods Restoration Framework  
- Compensation at replacement values for loss of income from permanent crops.  
- Compensation at replacement values for lost lands.  
- Compensation at replacement values for lost land rights.  
- Compensation at replacement values for lost assets  
- In line with LEA procedures TAP will provide compensation prior to construction | MINOR  
- A small number of households will be affected by the permanent loss of their crops.  
- Crop loss will affect a small proportion of farmers overall permanent crop land.  
- If well designed, compensation should re-establish livelihood. |
| Changes in land values post construction | Systematic engagement with local authorities in order to cover the entire range and all levels of local and regional planning which will be affected by the Project  
- Affected land owners and/or right holders are entitled to cash compensation at replacement values for the reduced opportunities to use the land most productively (lost stumpage value). | MINOR  
- It is unclear how many landowners will be affected by changes to land value, although it is likely to be a relatively small number, depending on size and location of each property.  
- Changes to land value will be permanent. |

ERM (2012), ASPROFOS (2013)

8.11.4 Decommissioning Phase

The following section outlines the impacts to livelihoods and land values during the projects decommissioning phase.

8.11.4.1 Potential Impacts

8.11.4.1.1 Temporary use of land due to decommissioning activities

The decommissioning phase will require the temporary use of the land in and around the BVSs and, depending on best practice at the time of decommissioning, might also require land along
the pipeline route. This will result in temporary impacts on land-based activities and respective livelihoods.

8.11.4.1.2 Restoration of Land Use

The change in land use from an industrial site back to agricultural land, as far as is reasonably possible, will have a positive impact on the value of land surrounding the site. The option to change land use of the 8 m pipeline protection strip back to agricultural use, i.e., by permanent crops, is expected to have a positive impact on agriculture in the area.

8.11.4.2 Mitigation Measures

TAP AG have committed to restoring the land used for permanent facilities to its pre-construction state when operations close.

Due to the length of time between pre-construction and decommissioning and that changes that will occur in the study area during this time, TAP AG will carry out a specific Decommissioning Impact Assessment in order to understand the impacts and impact receptors for decommissioning. As part of this TAP AG will assess how the land will be converted when operations cease considering the best value and most appropriate land use. The decommissioning impact assessment will include a decommissioning plan, which will include a description of land reclamation, a timeframe for all decommissioning activities, a description of impacts and how mitigation measures will be implemented and a monitoring program.

Central to the decommissioning impact assessment will be consultation with affected stakeholders, including local communities and local and regional authorities. Consultation will commence prior to closure to inform stakeholders of the timeframe for closure and enable feedback throughout the decommissioning process.
8.11.4.3 Residual Impacts

Table 8-74 Residual Impacts – Lands and Livelihoods – Decommissioning Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary use of land due to decommissioning activities</td>
<td>Meet with neighbouring communities close to the permanent facility site prior to closure to discuss the decommissioning timeframe and process.</td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>▪ Provide communities with a point of contact should they have any questions or concerns regarding the decommissioning process.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Undertake an impact assessment to understand how the decommissioning process will impact local communities and land owners.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Monitor implementation of mitigation measures and decommissioning planning to ensure that stakeholders are kept informed and not unduly affected by the process.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Take particular care to ensure that vulnerable groups are considered and not unduly affected by the decommissioning process.</td>
<td></td>
</tr>
<tr>
<td>Restoration of land use</td>
<td>Meet with neighbouring communities close to the permanent facility site prior to closure to discuss the decommissioning timeframe and process and to ensure stakeholders are kept informed and not unduly affected by the process.</td>
<td>MINOR - POSITIVE</td>
</tr>
<tr>
<td></td>
<td>▪ TAP AG will assess how the land will be converted when operations cease considering the best value and most appropriate land use.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Take particular care to ensure that vulnerable groups are considered and not unduly affected by the decommissioning process.</td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012) and ASPROFOS (2013)

8.11.5 Summary of Impacts on Land and Livelihoods

Land use and Ownership

The Project will require permanent land take for the above ground installations, i.e. GCS00, GCS01 and BVSs. Overall the permanent land take for these installations totals approximately 74 ha, which is predominantly agricultural land. TAP AG will acquire the land for the aboveground installations. The present landowners will be compensated at replacement value (market value
plus any transaction costs). The ownership of certain upgraded roads will remain with the present owners (municipalities and forest).

Pipeline construction requires a temporary land take of roughly total 2,145 ha which is a result of the working strip, pipe yards and camps, etc. Out of the total of about 2,063 ha within the working strip about 1,735 ha are agricultural lands (i.e. about 84% of the working strip) of which approximately 1,195 ha is agricultural lands and pastures, 514 ha irrigated agriculture and 41 ha fruit trees, olive groves and vineyards.

Following completion of construction, reinstatement and planting (i.e. shrubs to stabilise the soil) along the pipeline route will be undertaken in accordance with a *Landscape Management Plan* (refer to Section 9.3.18). This will aim at restoring the environment to preconstruction conditions as far as possible. The pre-construction situation will be surveyed and recorded as baseline for compensation. Reinstatement measures will be agreed with the land owners / users and the local administration. Erosion protection measures will be applied as required, land drainage will be reinstated and affected irrigation systems and local roads and tracks will be repaired if damaged during construction.

In order to address land related issues and in particular compensation, TAPAG has developed the LEA - *Land and Easement Acquisition Strategy* and the Draft Land Access Plan (see Section 8.11.2.2).

The ownership of the land on the pipeline route will change, but the land will be subject to land easements which restrict future land use by the landowners. This includes a permanent pipeline protection strip (PPS) of 8 m width where no planting of trees or deep rooting permanent crops will be allowed. Agricultural works with annual crops can be carried out without problems after the pipeline has been laid, as the minimum cover of the pipeline will be not less than 1 m. Fruit trees etc. can be replanted in the working strip during reinstatement, but the PPS must be kept free from large bare-rooted trees.

Safety zone restrictions on further building activities will be communicated to the affected communities in proximity to the safety zone (20 m single building, potentially 200 m building cluster).
The landowners and users will be compensated for losses and damages incurred during construction. This includes inter alia loss of structures (e.g. greenhouses, irrigation equipment), permanent crops (e.g. apple trees) and loss of harvest, or any damage to buildings, etc. Compensation is further considered to cover for restrictions that will affect their lands due to pipeline integrity protection and public safety reasons (PPS and safety strip).

Compensation for permanent and temporary land take will be carried out according to Greek regulations and EBRD’s PR5. TAP AG will set-up an LRF and details about compensation will be communicated with private and public landowners/users and agreements on land purchase and easement rights will be made well in advance of construction commencing.

Livelihoods
Since the agriculture structure in the region along the route frequently consists of smallholdings which are of significance for household incomes and foodstuff self-supply, actual livelihood impacts will need to be further addressed after a complete survey of the route. Further activities of local people that herd animals or collect forest produce are likely temporary affected, however mostly for few weeks only until the pipeline is laid and construction has moved on; such impacts will also be investigated in more detail.

A draft Livelihood Restoration Framework (LRF) has been developed by TAP AG. Entitlements for affected persons will be communicated before the Project construction commences. Entitlements will be defined in accordance with EBRD’s PR5. In the interim, whilst the LRF is being finalised, a preliminary LEA - Land and Easement Acquisition Strategy leaflet is being drafted by TAP AG, which identifies the type of impact from land and easement acquisition for each Project activity and provides guidance on how stakeholders should be compensated. The LRF will be further complemented by a Livelihood Restoration Plan (LRP) that will allow one to identify all impacts and compensation in detail based on surveys undertaken.
8.12 Infrastructure and Public Services

8.12.1 Overview

The 543 km pipeline route in Greece will inevitably cross a large number of roads and infrastructures with important functions for local stakeholders. Impacts to infrastructure will occur during pipeline construction mainly as a result from trenching and laying of the pipeline across roads and other infrastructure such as irrigation systems and utility lines.

In addition, the Project intends to upgrade approximately 27 km existing tracks in TAP Greece West section, mainly in hilly terrain, in order to allow the passage of trucks with pipe trailers to access the pipeline working strip. Since for TAP Greece East section the pipeline route is quite parallel to the existing DESFA pipeline, existing access roads from previous construction will be used. Potential development of existing roads in TAP Greece East is under investigation and will be established early in the construction phase.

Figure 8-25 presents the sections of access roads to be upgraded in TAP Greece West. Figure 8-26, Figure 8-27 and Figure 8-28 show the areas where irrigation systems will be crossed throughout the Project area. For further information on locations of private pump houses for irrigation within the 40 m safety zone affected by the Project refer to Section 8.11.2.2.2.
Figure 8-25  Overview of Road Sections to be Upgraded in TAP Greece West

Source: ERM (2012)
Figure 8-26 Overview of Irrigated Land Crossed by Proposed Pipeline in TAP East Section (a)

1. Groundwater fed from boreholes + riverfed irrigation with underground distribution pipe network [KP 0-66]
2. Groundwater fed from boreholes, distributed by water cannons; underground distribution pipe network 1m deep in some areas [KP 66-91]
3. Groundwater fed from boreholes [KP 87-105]
4. Groundwater fed from boreholes [KP 103-126]
5. Groundwater fed from boreholes; distribution pipe network in some areas [KP 126-144]
6. Riverfed irrigation through boreholes; channel distribution pipe network [KP 145-154]
7. Riverfed irrigation through boreholes; channel distribution network [KP 154-176]

Source: ASPROFOS (2013)
Figure 8-27 Overview of Irrigated Land Crossed by Proposed Pipeline in TAP East Section (b)

Source: ASPROFOS (2013)
Key consideration for assessing impacts of the Project on roads, infrastructure, and utility services are presented in *Box 8-12.*
Box 8-12    Key Considerations for Assessment – Infrastructure and Public Services

Sources of Impact/Risk

- Construction of approximately 543 km of pipeline between Kipoi (Greek-Turkish border) and the Greek/Albanian border
- Installation of compressor stations GCS00 near Kipoi and GCS01 near Serres (not included in the initial stage of construction)
- Set-up of temporary construction facilities (construction camps, pipe yards, water network and associated infrastructure) along the pipeline route
- Upgrade of approximately 27 km existing local roads and tracks for construction access in TAP Greece West section. Potential development of existing roads in TAP Greece East is under investigation.

Potentially Impacted Resources and Receptors

- Settlements near construction sites or along access roads
- Households reliant on local services and infrastructure (i.e. electricity, piped water, sanitation…)
- Local utilities companies in charge of supply of electricity and waste related services
- Different types of local irrigation systems including supply canals, under and above ground distribution pipe systems and wells
- Road users on roads crossed by the pipeline and near construction sites.

Particular Baseline Conditions that are Potentially Influencing Impacts/Risks

- Well established road network
- Good level of utility services infrastructure
- Complexity of irrigation systems

Vulnerable Groups

- Small scale agriculture based businesses that rely on irrigation and access to their plots
- Elderly and sick individuals living in settlements when access to local centres impacted by construction activities or temporary disruption of water and power supply during crossing works of supply lines.

References

- Baseline is found in Section 6.4.6. Impact Assessment Criteria is found in Annex 5.8. Monitoring Measures are described in Section 9.2.

Source: ERM (2012) and ASPROFOS (2013)

Important impact to infrastructure includes temporary loss of its function. Access and services interruption, if poorly managed, could potentially adversely affect local settlements and local traffic (e.g. piped water restrictions, inability to pass roads in an emergency etc.), and could impact on income and livelihoods where irrigation systems are disrupted. During consultations in the settlements along the route during September 2011 for TAP Greece West and January 2013 for TAP Greece East, no particular location specific road or transportation related concerns were pointed out by local stakeholders, but concerns regarding disruption of irrigation infrastructure, in particular loss of wells were raised.
Table 8-75 presents the key anticipated impacts of the Project on roads utilities services lines and other infrastructures during the main project phases.

Table 8-75   Key Potential Impacts – Utilities Services and Infrastructures

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Temporary disruption of roads and other infrastructure and hindrance of utility services during pipeline construction and access road upgrades</td>
<td>• Improved driving conditions on upgraded access road sections, where upgrade remains permanent (however, some upgraded sections will be likely decommissioned after pipeline construction for nature conservation reasons).</td>
<td>• Temporary disruption and hindrance of infrastructure and utilities similar to construction, in case the pipeline is taken out of the ground (depending on the decommissioning best practice at that time).</td>
</tr>
<tr>
<td>• Temporary interruption of irrigation where the pipeline crosses irrigation systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Short term interruption of water supply and other public services where pipeline crosses such supply lines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Loss of wells, in case cannot be avoided by micro-rerouting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012)

8.12.2  Construction and Pre-commissioning Phase

8.12.2.1  Potential Impacts

8.12.2.1.1  Roads

The pipeline route crosses 14 highways, 59 major roads, and approximately 159 secondary roads and carriage ways. Considering all small tracks, in total about 1,443 communication infrastructure features will be crossed.

Road crossing by the pipeline will be accomplished by different techniques, depending on the classification of the road and local circumstances (as further described in Section 4.4.5):

- In line with international best pipeline construction practice, all major roads, such as the Egnatia Highway, national and regional main roads are planned to be crossed by trenchless methods. This will avoid any immediate impact on the infrastructure and its function, i.e. will avoid traffic disruption on the crossing location.
- Secondary roads (e.g. municipal, local, forest, private roads) other carriage ways and tracks will be crossed by open cut as a standard technique.
TAP AG is committed to maintaining the existing road network open for public use throughout construction and to put diversions in place should construction activities require temporary closure of a roadway to construct the pipeline crossing. This is of particular importance for the settlements listed in Table 8-76, where the road that is being crossed by the pipeline is the only/main access in/out of the village (i.e. no alternative access routes exist).

<table>
<thead>
<tr>
<th>Table 8-76</th>
<th>Crossing of roads with Settlement Access Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline chainage (KP)</td>
<td>Municipality</td>
</tr>
<tr>
<td>28.5; 31.5</td>
<td>Alexandroupoli</td>
</tr>
<tr>
<td>113.4</td>
<td>Iasmos</td>
</tr>
<tr>
<td>261.7 – 264.9</td>
<td>Emmanouil Papa</td>
</tr>
<tr>
<td>301.5</td>
<td>Iraklia</td>
</tr>
<tr>
<td>431.7</td>
<td>Edessa</td>
</tr>
<tr>
<td>459.6</td>
<td>Amyntaio</td>
</tr>
<tr>
<td>469.0 – 471.0</td>
<td>Eordea</td>
</tr>
<tr>
<td>479.1</td>
<td>Eordea</td>
</tr>
<tr>
<td>493.1</td>
<td>Kastoria</td>
</tr>
</tbody>
</table>

Compiled by ERM (2012) and ASPROFOS (2013)
According to the Logistics Concept\textsuperscript{60} for TAP Greece West, several sections of the local road and pathways network will be upgraded to facilitate suitability for access of line pipe trucks and machinery to the pipeline construction strip. These upgrade sections total 27 km are summarised in Table 8-77. Upgraded roads will remain in the present ownership and maintenance responsibility. Potential development of existing roads in TAP Greece East is under investigation and will be established early in the construction phase.

\textbf{Table 8-77 Road upgrades required for pipeline construction access}

<table>
<thead>
<tr>
<th>Approximate vicinity of Pipeline at Chainage (KP)</th>
<th>Municipality</th>
<th>Location and existing road type</th>
<th>Length of upgrade</th>
<th>Envisaged future status</th>
</tr>
</thead>
<tbody>
<tr>
<td>423.9 – 425.5 Naousa / Edessa</td>
<td>Track westward out of Polla Nera</td>
<td>2.1 km</td>
<td>Upgrade is intended to remain in place after pipeline has been installed</td>
<td></td>
</tr>
<tr>
<td>426.4 – 431.8 Edessa</td>
<td>Gravel track across Vermio Mountain slopes between Polla Nera and Agia Fotini</td>
<td>6.6 km</td>
<td>Reinstatement to narrower profile or access restriction after pipeline construction for wolf and bear habitat function protection.</td>
<td></td>
</tr>
<tr>
<td>441.5 Edessa</td>
<td>Local forest gravel road between Ano Gramatiko and KP446</td>
<td>4 km</td>
<td>Reinstatement to narrower profile or access restriction after pipeline construction for wolf and bear habitat function protection.</td>
<td></td>
</tr>
<tr>
<td>443.2 Edessa</td>
<td>Local gravel road leading south out of Kato Grammatiko village to working strip at KP447.7</td>
<td>1.7 km</td>
<td>Upgrade is intended to remain in place after pipeline has been installed</td>
<td></td>
</tr>
<tr>
<td>489.5 – 492.2 Amyntaio / Kastoria</td>
<td>Local gravel road starting to the north of Variko and leading to the lower parts of Kleisoura.</td>
<td>5.2 km</td>
<td>Reinstatement to narrower profile or access restriction after pipeline construction for bear habitat function protection.</td>
<td></td>
</tr>
<tr>
<td>494.0 – 496.8 Kastoria</td>
<td>Local gravel road on the western downslope of Kleisura pass</td>
<td>2.7 km</td>
<td>Reinstatement to narrower profile or access restriction after pipeline construction for bear habitat function protection.</td>
<td></td>
</tr>
<tr>
<td>530 - 534 Kastoria</td>
<td>Local side road between Mesopotamia and Agia Kyriaki</td>
<td>4.1 km</td>
<td>Upgrade is intended to remain in place after pipeline has been installed</td>
<td></td>
</tr>
<tr>
<td>533 – 543.16 Kastoria</td>
<td>[Information for logistics roads / access roads up of areas near Greek/ Albanian border not yet available at time of writing this ESIA section, March 2012]</td>
<td></td>
<td>Reinstatement to narrower profile or access restriction after pipeline construction for wolf and bear habitat function protection.</td>
<td></td>
</tr>
</tbody>
</table>


\textsuperscript{60}Logistics Concept Greece (Doc.Ref.: GPL00-ILF-100-F-TRP-0003 Rev.0D, ILF, 2012)
As shown in the table, for some sections through more remote wooded hill lands and forest areas, the biodiversity impact assessment (Section 8.8) has identified the requirement to minimise future accessibility in order to maintain the presently relative undisturbed wolf and bear habitats. Subject to agreements with the nature conservation authorities and the road owners, these upgraded sections will be partly or fully reduced to previous width, or access will be restricted to previous status to avoid increase of permanent disturbance factors for sensitive fauna (i.e. wolves and bears).

8.12.2.1.2 Railways and Riverine Transport

The pipeline route crosses 4 railway lines at 13 locations as listed in Table 8-78. Railways will be crossed by trenchless methods (as described in Section 4.4.5) that will not interfere with or interrupt railway operations.

<table>
<thead>
<tr>
<th>Pipeline Crossing Point (KP)</th>
<th>Railway Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td>Alexandroupoli – Thessaloniki</td>
</tr>
<tr>
<td>42.1</td>
<td>(single track/non-electrified)</td>
</tr>
<tr>
<td>66.3</td>
<td></td>
</tr>
<tr>
<td>95.2</td>
<td></td>
</tr>
<tr>
<td>123.5</td>
<td></td>
</tr>
<tr>
<td>131.9</td>
<td></td>
</tr>
<tr>
<td>224.6</td>
<td></td>
</tr>
<tr>
<td>250.0</td>
<td></td>
</tr>
<tr>
<td>254.1</td>
<td></td>
</tr>
<tr>
<td>264.9</td>
<td></td>
</tr>
<tr>
<td>353.9</td>
<td></td>
</tr>
<tr>
<td>369.3</td>
<td>Thessaloniki – Idomeni</td>
</tr>
<tr>
<td></td>
<td>(single track/electrified/freight only)</td>
</tr>
<tr>
<td>417.7</td>
<td>Veria – Edessa</td>
</tr>
<tr>
<td></td>
<td>(single track / non electrified)</td>
</tr>
<tr>
<td>467.4470.5</td>
<td>Kozani Amynteo</td>
</tr>
<tr>
<td></td>
<td>(single track / non-electrified/ freight only)</td>
</tr>
</tbody>
</table>

Compiled by ERM (2012) and ASPROFOS (2013)

None of the 23 large rivers and channels crossed by the pipeline route, including Evros River, Nestos River, Axios River and the Aliakmonas River, are navigable and therefore, the Project will not affect any water based transport.
8.12.2.1.3 Utilities - Interruption of Utility Lines and Services

Crossing of third party underground utility supply lines, e.g. water pipes and power supply lines, or sewage discharge pipes will be crossed by established construction methods, such as open cut or trenchless technology where required. For each crossing a dedicated Crossing Agreement will be made with the utility/owner. Any disruption to utilities will depend on the crossing method. The crossing method, along with provisions or limitations will be determined in collaboration with the relevant authority. Thus, short term interruptions of typically a few hours might occur (similar to repair works of ruptures of public water supply lines) and the affected stakeholders and local population will be informed ahead of construction by local announcements accordingly.

Where utility facilities existing sufficiently close enough to the Project works, and there is sufficient supply capacity, services and utilities (i.e. water supply, wastewater and sanitation services, electricity supply, potable water supply, and solid waste management) will be purchased from local suppliers and utility companies will be commissioned to extend transmission lines or water pipes to worksites. This may result in some short-term planned disruption to water supplies or electricity services. Where local capacity is insufficient, contractors will establish their own temporary stand-alone services on site to avoid increasing pressure on existing utility supplies.

Special reference should be made to the existing pipeline which is a natural gas pipeline, running from Kipoi to Nea Mesimvria. TAP following the bunding principle has stayed as close as possible to the existing pipeline to minimize impact as best industry practice. All technical details related to construction (crossing and proximity) and operational issues are currently being developed through close collaboration with the existing pipeline owner. Thus it should be clarified that no impact will incur to the existing pipeline.

Finally, it is envisaged that the compressor stations will be supplied with potable and service water from the local network and sewage and effluent will be treated on-site by compact wastewater treatment units. No potential impact on existing utilities is expected provided that the local network provider has the capacity to supply the required quantities (see Section 4).
8.12.2.1.4 Irrigation Systems

The potential for impacts to irrigation systems is primarily related to the need to cross such infrastructures during pipeline construction. Construction activities could potentially cause temporary loss of water flow in irrigation systems as a result of planned disruption or accidental damage to the irrigation systems or permanent losses of structures and wells in case they cannot be avoided by final micro-routing and working strip layout.

As described in the socioeconomic baseline (Section 6.4), a number of communities along the pipeline route rely on irrigation of different methods for their income from agriculture. Disruption of water supply for agricultural purposes may impact on their income livelihood in case the irrigation system is interrupted for a longer period, especially at the time of year when the irrigation water is needed for cultivation. The irrigation sections along the route being vulnerable to water supply interruption are presented in Figure to Figure 8-28. A detailed list of the irrigation systems identified along the TAP route within the 500 m corridor on settlement level is presented in Section 1.6 of Annex 6.3.

8.12.2.2 Mitigation Measures

8.12.2.2.1 TAP Mitigation Approach

TAP AG’s Policy on Corporate Social Responsibility (Doc.Ref. TAP-HSE-PO-0002) contains the commitment to avoid, minimise, mitigate, offset and/or compensate all adverse impacts resulting from project development. TAP AG is committed to building its own project related infrastructure, such as access roads, camps, and sewage systems in a way which allows neighbouring communities to benefit from them on a permanent basis where that is possible. Moreover, TAP AG is committed to enhancing local development through social and environmental investments (SEI) in living conditions in neighbouring communities (Strategy for Social and Environmental Investments, Doc.Ref. TAP-HSE-ST-0006).

TAP AG also has a Stakeholder Engagement Strategy (TAP- EXT-ST-0006) in place, which commits TAP AG to continue effective engagement with stakeholders in particular those in the immediate vicinity of the construction works through providing up-front information and
communication avenues to raise any concerns and grievances, and in particular by having community liaison personnel on site for direct contact with stakeholders:

- Community liaison officers will be present at work fronts to ensure that impacts from planned disruptions are minimised and that any unplanned disruptions are properly managed (see also Section 8.15 Community Cohesion).
- A Grievance Mechanism is in place so that affected stakeholder concerns are addressed promptly and effectively, using an understandable and transparent process that is culturally appropriate and readily accessible to all segments of the affected parties at no cost and without retribution. Access of affected stakeholders to a compensation process in case any unplanned disruption results in loss of livelihoods is also part of that Grievance Mechanism.

This commitment will be especially important with regard to disruption of irrigation systems and public road access to settlements and agricultural areas.

Particular mitigation measures to address impacts to infrastructure as mentioned above in the impact discussion are summarised in the following Sections.

8.12.2.2 Disruption and damage to roads, infrastructure and utilities

Road and other transportation infrastructure
For all road (and rail) crossing, agreements will be made with the public or private owners and in consultation with local municipalities and regional road agencies and public notice of construction activities and implications will be locally made available.

Whilst for the large roads, trenchless crossings will be used to avoid interruption of traffic flow, crossings of smaller roads can typically be accomplished within a short time so that road passage at these locations usually will be interrupted for no longer than 1–3 days. Temporary diversions will be established where no reasonable alternative local access exists. For all those roadways that serve as village/settlement access or regular service e.g. of local buses, access to agricultural lands etc., a temporary local diversion will be established (typically, short temporary gravel road next to the crossing section) to ensure uninterrupted accessibility of settlements. After the pipeline is installed at the crossing, all damage to public or private roads will be repaired.
and the conditions prior to pipeline construction will be reinstated in agreement with local authorities and infrastructure owners.

As a general commitment of TAP AG, repair/upgrade work on roads required prior to heavy transportation, maintenance of access roads during construction and reinstatement works after completion of the pipeline construction will be financed by TAP AG.

**Utilities**

An Infrastructure and Utilities Management Plan will be developed prior to implementing works. TAP AG via the EPC contractor will conduct an assessment as part of the detailed engineering process to determine whether to invest in public utilities or be self-sufficient. It is envisaged that during the utility assessment due consideration will be given to the situation of settlements and industry close or in the vicinity of the construction camps and pipe yards and other associated facilities to ensure no reduction in services available to local settlements occurs.

Further, a number of measures will be implemented to minimise impacts on utilities:

- Documented agreements with utility companies and local authorities and private owners will be made by contractors prior to construction.
- Confirmation of reinstated post construction status signed off by land owner.
- Engagement with local authorities and utilities companies to ensure continuity of utility supply to communities. Only short term ‘planned‘ disruption to drinking water or electricity services, limited to the extent possible, but at maximum will not exceed a 12 hour period.
- The Project will work with local utilities companies to ensure coordinated and rapid response to unplanned events such as damage to electric lines and water pipes. TAP AG recognises that investment may be required to ensure an adequate preparation and response by utility companies.

8.12.2.2.3 Irrigation systems and water supply

Due to the nature of works (*i.e.* pipeline trenching), temporary disruption of irrigation systems is unavoidable. TAP AG is committed to minimising impacts of disruptions on agricultural production
through planning of construction works in cooperation with local communities and owners of the irrigation and water supply structures.

TAP AG will establish an *Irrigation Continuity Plan* prior to construction which will address the following key items:

- A survey will be performed to understand how local irrigation systems and their water supply (incl. boreholes, wells and other structures such as pump houses), times when water is needed for irrigation, which quantities and which network and irrigated area (outreach of supply of an affected irrigation feeder /supplied area) will be affected when the system is cut by the pipeline trench.

- Detailed planning of measures to provide water supply by-passes and ensure continued irrigation flow during pipeline construction and consequent rehabilitation of irrigation systems.

- Documented agreements with utility companies and local authorities and owners of structures will be made by contractors prior to construction.

- A community liaison officer will be present at each work front to immediately capture complaints.

- Post construction status assessments by independent experts (e.g. chamber of agriculture) to ensure that function of irrigation system has been properly reinstated, sign off by land owners.

- The Project put in place a Grievance Mechanism to follow-up and close out any issues reported by stakeholders.

- Where reconstruction or relocation of wells (including boreholes) requires renewal or first time water permits in line with the pertinent regulatory requirements, TAP AG will manage this on behalf of the affected owners and will bear any associated costs. Alternatively, TAP AG will arrange for the planning and implementation of alternative modes of water supply.

- In case interruptions of irrigation system should occur that lead to undersupply and resulting crop damage or losses, TAP AG will pay damage compensation.

- To avoid disputes, subject to further discussion with the different entities that are in charge of the irrigation systems, temporary flow meters could be installed at irrigation system main feeder crossings to establish actual impacts on water supply quantities.
8.12.2.2.4 Benefit Enhancement Measures

Aside from the above temporary disruption of infrastructures, Project implementation will also help to improve regional infrastructures. For Project implementation about 10 km of existing roads and tracks will be upgraded to gravel road standard and are intended to remain in place after pipeline has been installed. These upgrades of existing roads will take place in the municipality of Edessa and Kastoria.

Other infrastructure such as telecommunications, sewage, waste and possibly health facilities might be enhanced to support construction activities. TAP AG is committed to continue working with government and local communities to achieve sustainable benefits for local settlements through the hand-over of these.

TAP AG will develop an *Infrastructures and Utilities Management Plan* to maximise the use of Project infrastructure with a view on community needs. The *Plan* will be developed in close coordination with local utilities companies, authorities at the regional and local level and communities to ensure the appropriateness and sustainability of investment and will also be published and undergo a consultation process with affected communities.

8.12.2.3 Residual Impacts

| Table 8-79 Residual Impacts - Infrastructure and Public Services – Construction Phase |
|--------------------------------------|---------------------------------|---------------------------------|
| **Impact / Risk** | **Measures to Address the Impact / Risk** | **Significance of Residual Impact / Risk** |
| Utilities Services and Infrastructures | | |
| Disruption and damage to infrastructure and utilities during construction (including road upgrade activities) | • Road (and Rail) Crossing Agreements | MINOR |
| | • Irrigation Continuity Plan | Mitigation measures should ensure disruption to infrastructure and utilities are minimised |
| | • Community Liaison and Grievance Mechanism | |
| | • Infrastructures and Utilities Management Plan | |

*Source: ERM (2012)*
8.12.3 Operation and Maintenance Phase

During operation and maintenance no significant adverse impacts on infrastructures and utilities are anticipated.

Localised temporary disruption of supply lines could occur in case of repairs of the pipeline system. However, these should be very rare, since the pipeline integrity will be protected by a range of measures (see Section 4.8.6). Mitigation measures for such cases will be planned and implemented in consultation with local authorities and infrastructure owners.

Residual adverse impacts from operation and maintenance are thus not significant, and there is little positive spin-off potential either.

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilities Services and Infrastructures</td>
<td>- Continued use of roads and other infrastructure benefits by local communities.</td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td></td>
<td>- Strategic decision regarding provision of fibre optic capacity to local communication companies</td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012)

8.12.4 Decommissioning Impacts

The nominal lifetime of the pipeline is 50 years. It cannot be foreseen which approaches will be taken at the time of decommissioning. Impacts will obviously depend on the state-of-the-art decommissioning approach and available dismantling techniques that are taken. International present practice (with few precedence being available) is to leave a pipeline in the ground and secure it against structural collapse. In that case impacts on infrastructure will be minimal. If the pipeline will be taken out, e.g. to recover the pipe steel, impacts could be similar to, but likely less than at construction stage as infrastructure crossings are already technically mitigated with initial construction (i.e. at road and other infrastructure crossing the pipe will simply remain in place and the structural status will be secured). Any decommissioning activities will be subject to permitting requirements applicable at that time and subject to consultation with affected owners and stakeholders of affected properties and structures. A Decommissioning Impact Assessment will...
be conducted prior to decommissioning and until that time a respective impact rating is provided in Table 8-81.

### Table 8-81 Residual Impacts - Infrastructure and Public Services – Decommissioning Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilities Services, Roads and Infrastructures</td>
<td>State-of the-art decommissioning approaches and dismantling/securing techniques will be used</td>
<td>NEGLIGIBLE to MODERATE in case the pipeline is abandoned in situ; if pipeline is taken out, it is assumed that infrastructure crossings will remain</td>
</tr>
<tr>
<td></td>
<td>Decommissioning will be subject to permitting regulations pertinent at that time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depending on commissioning concept, the same mitigation measures as for construction stage will apply</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Owners and relevant stakeholders will be consulted pre-decommissioning.</td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012)

#### 8.12.5 Summary of Impacts on Infrastructure and Public Services

The 543 km pipeline route through Greece will inevitably cross a number of infrastructures and utilities. Crossing activities will lead to temporary inconveniences such as delays and detours for road users as well as disruption to irrigation and drainage systems.

**Road infrastructure:** In line with international best pipeline construction practice, major roads, such as the highways, national and regional main roads and railway lines will be crossed by trenchless methods. This will avoid any immediate impact or traffic disruption on the infrastructure and will avoid traffic disruption on the crossing location. Secondary roads (e.g. municipal, local, forest, private roads) and other carriage ways and tracks will be crossed by open cut as a standard technique. Such crossings of smaller roads can typically be accomplished within a short time so that road passage at these locations usually will be interrupted for no longer than 1 – 3 days. Temporary diversions will be established where no reasonable alternative local access exists. For all those roadways that serve as only settlement access or regular service e.g. of local buses, access to agricultural lands etc., a temporary local diversion will be established (typically, short temporary gravel road next to the crossing section) to ensure uninterrupted accessibility of settlements. After the pipeline is installed at the crossing, all damage to public or private roads will be repaired and the conditions prior to pipeline construction will be reinstated in agreement with local authorities and infrastructure owners.
Irrigation and Drainage systems: TAP AG will establish via surveys an understanding of local irrigation systems and their water supply (incl. boreholes, wells and other structures such as pump houses), times when water is needed for irrigation, which quantities and which network and irrigated area (outreach of supply of an affected irrigation feeder /supplied area) will be affected when the system is cut by the pipeline trench. Based on this, detailed planning will be made of measures to provide water supply bypasses and ensure continued irrigation flow during pipeline construction and consequent rehabilitation of irrigation systems. The same approach will apply to the drainage / flooding channels.

Utility lines: Crossing of third party underground utility supply lines, e.g. gas pipeline, water pipes and underground power supply lines, or sewage discharge pipes will be crossed by open cut or trenchless technology where required. Short term interruptions of typically a few hours will occur and the affected stakeholders and local population will be informed ahead of construction by local announcements accordingly. This will be especially important with regard to disruption of irrigation systems and public road access to settlements and agricultural areas.

For all infrastructure crossings, documented Crossing Agreements will be made with the public or private owners and works will be carried out in consultation with local municipalities and regional agencies in charge. For crossings of the existing gas pipeline network, works will be carried out in collaboration with the owner (i.e. DESFA).

Benefit Enhancement Measures: Besides the above temporary disruption of infrastructures, Project implementation will also help to improve regional infrastructures such as telecommunications, sewage, waste and possibly health facilities. TAP AG is committed to continue working with government and local communities to achieve sustainable benefits for local settlements through the hand-over of these. TAP AG will develop an Infrastructures and Utilities Management Plan to maximise the use of Project infrastructure with a view to community needs.
8.13 Worker Management and Rights

8.13.1 Overview

Workers’ rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labour abuses and to ensure fair treatment, remuneration and working or living conditions. These issues should be considered not only for those who are directly employed by TAP AG but also its contractors (including sub-contractors) and within the supply chain.

The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the Project on worker management and rights.

Box 8-13 Key Considerations for Assessment – Worker Management and Rights

Sources of Impact/Risk
- Use of contractors and subcontractors. During construction approximately 2,700 workers will be employed by the Project directly and indirectly through contractors and subcontractors. During operation this number will fall to less than 150. During decommissioning, worker numbers will approximate that of construction.

Potentially Impacted Resources and Receptors
- Workers directly engaged by the Project both from Greece and overseas.
- Workers engaged through third parties from Greece or overseas (contracted workers).
- Workers engaged by the Project primary suppliers of goods and services.

Particular Baseline Conditions that are Potentially Influencing Impacts/Risks
- National Labour Laws and health and safety legislation in Greece exist and are in line with international standards providing a framework for the protection of worker management and rights.
- Labour unions in Greece are common in all industries and unionisation is a key element of Greek labour legislation, which is strongly upheld.
- The on-going financial crisis seems to have affected working practices, with workers showing more inclination to abandon labour rights in order to secure employment\(^6\).
- Collective agreements are common and define the conditions of employment including mandatory minimum wages and salaries, regulate cooperation, define rights and obligations of the contracting parties.

Vulnerable Groups
- Not applicable in this context.

References
Baseline is found in Section 6.4.4.10. Impact Assessment Criteria are found in Annex 5.8. Monitoring Measures are described in Section 9.2.

Source: ERM (2012) and ASPROFOS (2013)

The following table presents the key impacts of the Project on worker management and rights during key Project phases. Potential impacts on worker rights are discussed in further detail in the Human Rights Impact Assessment – Summary and Main Findings (see Annex 8.12, GAL00-EAL-642-Y-TAE-0001) being undertaken for the Project.

Table 8-82 Key Potential Impacts – Worker Management and Rights

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worker Health and Safety</td>
<td>Worker Health and Safety</td>
<td>Worker Health and Safety</td>
</tr>
<tr>
<td>Worker Rights</td>
<td>Worker Rights</td>
<td>Worker Rights</td>
</tr>
<tr>
<td>Forced Labour</td>
<td></td>
<td>Forced Labour</td>
</tr>
</tbody>
</table>

Source: ERM (2012)

TAP AG has a number of policies and strategies in place related to worker management and rights which are taken into account in the evaluation of impacts and statement of mitigation measures to be applied. These strategies are in line with the Greek legislation (see Annex 2) and international standards on worker rights and health and safety. However, some key parameters that will considerably influence the potential impacts associated with worker rights remain outstanding. These are:

- the country of origin of workers; and
- the country of origin of providers of goods and services.

8.13.2 Construction and Pre-commissioning Phase

8.13.2.1 Potential Impacts

8.13.2.1.1 Worker Health and Safety

Bearing in mind the nature of the activities being undertaken during construction, worker health and safety is a key risk area with the potential for accidents that may result in injuries and potentially fatalities as well as lost man-hours. Consequently, TAP AG has developed a series of
policies and strategies outlining its commitment to ensuring the health and safety of its workers as presented in Table 8-83. These strategies are in line with the Greek legislation and international standards on worker health and safety.

Within Greece, companies generally meet national and international standards around worker health and safety. This is ensured through the existence of strong unions and through the various government agencies that undertake inspections.

8.13.2.1.2 Worker Rights

The labour laws in Greece are in line with international labour laws and Greece has ratified the eight core ILO conventions:

- Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87);
- Right to Organise and Collective Bargaining Convention, 1949 (No. 98);
- Forced Labour Convention, 1930 (No. 29);
- Abolition of Forced Labour Convention, 1957 (No. 105);
- Minimum Age Convention, 1973 (No. 138);
- Worst Forms of Child Labour Convention, 1999 (No. 182);
- Equal Remuneration Convention, 1951 (No. 100);
- Discrimination (Employment and Occupation) Convention, 1958 (No. 111).

However, there are still some issues in Greece with regard to implementation including evidence that women are paid less and that migrant workers are more likely to be employed as day labourers or in temporary employment\(^6\). Furthermore, due to the economic crisis in Greece there is evidence that workers are willing to sacrifice their rights in order to find employment. As such there is a small risk that contractors will not be operating in line with international best practice if suitable measures to manage such risks are not enforced through the adherence to TAP AG policies (refer to Section 8.13.2.2).

8.13.2.1.3 Forced Labour

The use of forced labour is illegal in Greece and is not known to be an issue. It is therefore unlikely that the Project or its contractors and suppliers will be utilising forced labour of Greek origin, especially if TAP AG policies (as outlined in Section 8.13.2.2) are fully adhered to.

8.13.2.2 Mitigation Measures

Table 8-83 outlines the specific mitigation outlined in TAP AG’s policies. Specific commitments that will contribute to the mitigation of impacts and will need to be included in the management plans as highlighted in bold below.

<table>
<thead>
<tr>
<th>Policy Reference</th>
<th>Statements/ Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAP Health, Safety and Environment (HSE) Policy (2011) (TAP-HSE-PO-0001).</td>
<td>Sets out a clear commitment to ensuring the health and safety of TAP personnel encompassing contractor personnel through proactive risk management. TAP AG is committed to internationally recognised health, safety and environment standards and the use of best practice. Safety comes first. Facilities and operations will be developed, planned and maintained such that robust barriers are in place to prevent accidents. All employees have the duty to stop any works if adequate systems to control risks are not in place.</td>
</tr>
<tr>
<td>HSE Risk Management for TAP (TAP-HSE-PR-0006)</td>
<td><em>Surveillance programs for health status shall be established and implemented.</em></td>
</tr>
<tr>
<td>TAP Code of Conduct (2008) (TAP-GEN-PO-0001)</td>
<td>TAP strives to create a safe and healthy working environment. TAP works continuously on improving the Employee’s occupational health and safety conditions and the safety of its operations. Health and safety of Employees have priority and are a prerequisite for performing a good job. Therefore an Employee should not be under the influence of intoxicants... which could adversely affect the ability of that Employee to perform the work or adversely affect the health and safety of other Employees, other persons or the environment. The Code of Conduct is designed to preserve and foster the integrity and reputation of TAP and to help its employees and others who work for TAP to avoid misconduct. TAP promotes equal opportunity and diversity. No TAP employee or job applicant will be discriminated against on the basis of his or her gender, marital status, nationality, age, religion or sexual orientation ….. TAP strongly encourages its contractors to apply the same principles. The Code of Conduct includes an explicit commitment to full compliance with the International Labour Organisation Standards.</td>
</tr>
<tr>
<td>TAP Local Content Strategy (2010) (TAP-HSE-ST-0007)</td>
<td>Construction and Operation of TAP, in line with the highest health, safety, social and environmental standards, requires that all employees, contractors and suppliers comply with international best practice and performance requirements outlined in TAP AG’s governing documents.</td>
</tr>
</tbody>
</table>


Through the implementation of these policies, the Project has the opportunity to have a positive legacy in terms of worker rights and to avoid negative impacts to workers in terms of labour conditions, their welfare and health and safety.

8.13.2.2.1 Management Systems

- TAP AG will develop a health and safety management system. This management system will be enforced throughout the Project including all contractors and sub-contractors. It will include aspects such as identification and provision of PPE, regular training and monitoring as well as ongoing safety checks and safety audits.

- TAP AG will, as part of its Environmental and Social Management and Monitoring Plan; undertake social compliance monitoring to inform its internal auditing and monitoring process. As such, KPIs will be developed around worker rights, discrimination and management, workforce grievance mechanism and monitoring of outcomes.

TAP AG will review and monitor the outcomes of community engagement, media coverage and its workforce and community Grievance Mechanism for additional indications of labour related issues that may be arising. Specific best practice and measures that will be implemented and maintained through management systems to protect construction worker welfare include:

- Solid waste and waste water generated by construction activities will be managed and stored at construction sites and base camps in such a way as to minimise exposure to workers, as stated in the ESMMP. Those involved in the handling and management of waste will be provided with appropriate personal protective equipment (PPE) and training in handling of waste materials.
8.13.2.2.2 Contractor Management

- In all contractor contracts the Project will make explicit reference to the need to abide by Greek law, international standards and TAP AG’s policies in relation to health and safety, labour and welfare standards.

- As part of the contractor and supplier selection process TAP AG will take into consideration performance with regard to worker management, worker rights, health and safety as outlined in Greek law, international standards and TAP AG’s policies.

- TAP AG will provide support to contractors and subcontractors to ensure that labour and working conditions are in line with Greek law through gap analysis, awareness raising and information provision, as required.

- Contractor contracts will specify monitoring to be undertaken by the contractor, establish the right for TAP AG monitoring and auditing of all contractors and subcontractors and the consequences for the contractor if they are found to be in breach of national legal requirements, international standards, TAP AG policies or clauses in the contract. Contractor contracts will specify that the same standards will be met by their sub-contractors and suppliers.

8.13.2.2.3 Worker Rights

- During construction employees will be accommodated in camps. As outlined in the Project Description these will be constructed and managed in line with the IFC / EBRD guidance note (Workers Accommodation Processes and Standards). As such, accommodation conditions during construction should conform to international best practice.

- All workers (including those of contractors and subcontractors) will, as part of their induction, receive training on worker rights in line with Greek legislation to ensure that positive benefits around understanding labour rights are enhanced. This process will be formalised within the Code of Conduct Policy outlined in Table 8-83 and will be provided by TAP AG.

- All workers (including those of contractors and subcontractors) will have contracts which clearly state the terms and conditions of their employment and their legal rights. Contracts will be verbally explained to all workers where this is necessary to ensure that workers understand their rights. Contracts must be in place prior to workers leaving their home location.
All workers (including those of contractors and subcontractors) will be able to join unions of their choice and have the right to collective bargaining.

TAP AG and all contractors will put in place a worker grievance mechanism that will be accessible to all workers, whether permanent or temporary, directly or indirectly employed. The TAP AG worker grievance mechanism shall be open to the contractor and subcontractor workforce in the event that their grievance is not adequately resolved by their direct employer. TAP AG will then have the authority to act to resolve this grievance.

8.13.2.3 Residual Impacts

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| Worker Health and Safety | - Facilities and operations will be developed, planned and maintained such that robust barriers are in place to prevent accidents. All employees have the duty to stop any works if adequate systems to control risks are not in place.  
- Surveillance programs for health status shall be established and implemented.  
- Implementation of a health and safety management system covering all contractors and subcontractors including identification and provision of PPE, training and monitoring, as well as ongoing safety checks and safety audits.  
- In all contractor contracts explicit reference will be made to the need to abide by Greek law, international standards and TAP AG's policies in relation to health and safety,  
- As part of the contractor and supplier selection process TAP AG will take into consideration performance with regard to worker health and safety as outlined in Greek law, international standards and TAP AG’s policies.  
- TAP AG will provide support to contractors and subcontractors to ensure that labour and working conditions are in line with Greek law.  
- Contractor contracts will establish the right for TAP AG to monitor and audit all contractors and subcontractors and the consequences for the contractor if they are found to be breaching national legal requirements, international standards, TAP AG policies or clauses in the contract. Contractor contracts will specify that the same standards will be met by their sub-contractors and suppliers.  
- Accidents resulting in injuries or fatalities remain a possibility albeit with reduced likelihood due to the implementation of the management system.  
- Any injuries or fatalities could have long term impacts on workers and their families. | MODERATE |
<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| Worker Rights           | • TAP AG will put in place hiring mechanism to ensure no employee or job applicant is discriminated against on the basis of his or her gender, marital status, nationality, age, religion or sexual orientation  
• TAP AG will undertake socioeconomic compliance monitoring. KPIs will be developed around worker rights, discrimination and management, workforce grievance mechanism and monitoring of outcomes.  
• Worker accommodation will conform to international best practice.   | MINOR  
• As a result of the policies and procedures worker rights should be protected. If issues arise there is the opportunity for these to be identified and addressed through the worker grievance mechanism.                                    |
| Worker Rights (cont’d)  | • TAP AG will review and monitor the outcomes of community engagement, media coverage and its workforce and community grievance mechanism regarding labour issues.  
• In all contractor contracts explicit reference will be made to the need to abide by Greek law, international standards and TAP AG’s policies in relation to labour and welfare standards.  
• As part of the contractor and supplier selection process TAP AG will take into consideration performance with regard to worker management and rights as outlined in Greek law, international standards and TAP AG’s policies.  
• TAP AG will provide support to contractors and subcontractors to ensure that labour and working conditions are in line with Greek law.  
• Contractor contracts will establish the right for TAP AG to monitor and audit all contractors and subcontractors and the consequences for the contractor if they are found to be breaching national legal requirements, international standards, TAP AG policies or clauses in the contract. Contractor contracts will specify that the same standards will be met by their sub-contractors and suppliers.  
• TAP AG will provide as part of their induction, training on worker rights in line with Greek legislation. TAP AG will also require contractors and subcontractors to provide training on workers rights to its employees.  
• TAP AG will ensure that all its employees have contracts which clearly state the terms and conditions of their employment and their legal rights. TAP AG will also require contractors and subcontractors to include the terms and conditions of their employment and their legal rights in all contracts.  
• TAP AG will verbally explain contracts to all its workers where this is necessary. TAP AG will also require contractors and subcontractors to verbally explain contracts to its employees.  
• Contracts must be in place prior to workers leaving their home location. |
Impact / Risk | Measures to Address the Impact / Risk | Significance of Residual Impact / Risk
--- | --- | ---
• All workers (including those of contractors and subcontractors) will be able to join unions of their choice and have the right to collective bargaining.
• TAP AG will require all contractors and subcontractors to put in place a worker grievance mechanism that will be accessible to all workers. The TAP AG worker grievance mechanism shall be open to the contractor and subcontractor workforce in the event that their grievance is not adequately resolved by their direct employer. TAP AG will then have the authority to act to resolve this grievance.

Worker Rights (cont’d) | • TAP AG will develop a Human Resources Policy which will outline worker rights to be included in all contracts including restrictions on working hours in line with Greek and international law, compensation including consideration of overtime, holidays etc. TAP AG will require its contractors and subcontractors to put in place policies in line with national legislation. |

8.13.3 Operation and Maintenance Phase

8.13.3.1 Potential Impacts

During the operation and maintenance phase there is potential for impacts to occur related to worker health and safety, worker rights and the use of labour. However, due to the size of the workforce, reduced contractor hierarchy and the activities being undertaken the likelihood of this occurring is reduced when compared with the construction phase.

8.13.3.2 Mitigation Measures

The mitigation developed in the construction phase should be continued throughout the operations phase with consideration in the health and safety management system of the specific risks associated with operation and maintenance activities.
### 8.13.3.3 Residual Impacts

#### Table 8-85 Residual Impacts – Worker Management and Rights – Operation Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| **Worker Management** | Facilities and operations will be developed, planned and maintained such that robust barriers are in place to prevent accidents. All employees have the duty to stop any works if adequate systems to control risks are not in place.  
Surveillance programs for health status shall be established and implemented.  
Implementation of a health and safety management system covering all contractors and subcontractors including identification and provision of PPE, training and monitoring, as well as ongoing safety checks and safety audits.  
In all contractor contracts explicit reference will be made to the need to abide by Greek law, international standards and TAP AG’s policies in relation to health and safety,  
As part of the contractor and supplier selection process TAP AG will take into consideration performance with regard to worker health and safety as outlined in Greek law, international standards and TAP AG’s policies.  
TAP AG will provide support to contractors and subcontractors to ensure that labour and working conditions are in line with Greek law.  
Contractor contracts will establish the right for TAP AG to monitor and audit all contractors and subcontractors and the consequences for the contractor if they are found to be breaching national legal requirements, international standards, TAP AG policies or clauses in the contract. Contractor contracts will specify that the same standards will be met by their sub-contractors and suppliers. | MODERATE  
Accidents resulting in injuries or fatalities remain a possibility albeit with reduced likelihood due to the implementation of the management system.  
Any injuries or fatalities could have long term impacts on workers and their families. |
| **Worker Rights**   | TAP AG will put in place hiring mechanism to ensure no employee or job applicant is discriminated against on the basis of his or her gender, marital status, nationality, age, religion or sexual orientation.  
TAP AG will undertake socioeconomic compliance monitoring. KPIs will be developed around worker rights, discrimination and management, workforce grievance mechanism and monitoring of outcomes.  
Worker accommodation will conform to international best practice. | MINOR  
As a result of the policies and procedures worker rights should be protected. If issues arise there is the opportunity for these to be identified and addressed through the worker grievance mechanism. |
| **Worker Rights (cont’d)** | TAP AG will review and monitor the outcomes of community engagement, media coverage and its workforce and community grievance mechanism regarding labour issues.  
In all contractor contracts explicit reference will be made to the need to abide by Greek law, international standards and TAP AG’s policies in relation to labour and welfare standards. |  |
<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• As part of the contractor and supplier selection process TAP AG will take into consideration performance with regard to worker management and rights as outlined in Greek law, international standards and TAP AG’s policies.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TAP AG will provide support to contractors and subcontractors to ensure that labour and working conditions are in line with Greek law.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Contractor contracts will establish the right for TAP AG to monitor and audit all contractors and subcontractors and the consequences for the contractor if they are found to be breaching national legal requirements, international standards, TAP AG policies or clauses in the contract. Contractor contracts will specify that the same standards will be met by their sub-contractors and suppliers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TAP AG will provide as part of their induction, training on worker rights in line with Greek legislation. TAP AG will also require contractors and subcontractors to provide training on workers rights to its employees.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TAP AG will ensure that all its employees have contracts which clearly state the terms and conditions of their employment and their legal rights. TAP AG will also require contractors and subcontractors to include the terms and conditions of their employment and their legal rights in all contracts.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TAP AG will verbally explain contracts to all its workers where this is necessary. TAP AG will also require contractors and subcontractors to verbally explain contracts to its employees.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Contracts must be in place prior to workers leaving their home location.</td>
<td></td>
</tr>
<tr>
<td>Worker Rights (cont’d)</td>
<td>• All workers (including those of contractors and subcontractors) will be able to join unions of their choice and have the right to collective bargaining.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TAP AG will require all contractors and subcontractors to put in place a worker grievance mechanism that will be accessible to all workers. The TAP AG worker grievance mechanism shall be open to the contractor and subcontractor workforce in the event that their grievance is not adequately resolved by their direct employer. TAP AG will then have the authority to act to resolve this grievance.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TAP AG will develop a Human Resources Policy which will outline worker rights to be included in all contracts including restrictions on working hours in line with Greek and international law, compensation including consideration of overtime, holidays etc. TAP AG will require its contractors and subcontractors to put in place policies in line with national legislation.</td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012)
8.13.4 Decommissioning Phase

8.13.4.1 Potential Impacts

During the decommissioning phase there is potential for impacts to occur related to worker health and safety, worker rights and the use of forced labour. The workforce number and use of contractors will increase and as such there is an increased likelihood of impacts occurring.

8.13.4.2 Mitigation Measures

The mitigation developed during the construction phase should be continued throughout the decommissioning phase with consideration in the health and safety management system of the specific risks associated with decommissioning activities.

8.13.4.3 Residual Impacts

Residual impacts will be the same as all other Project phases.

8.13.5 Summary of Impacts on Workers Management and Rights

Construction and Pre-Commissioning Phase:
The construction workforce for the Project in Greece is a substantial number estimated at 2,700 for the main construction phase. Depending on the tendering outcomes, it is possible that workers may come from different regions of the world and different cultural backgrounds, and with different skill levels as required. Such complex situations bear a number of social risks. TAP AG will include social clauses in the EPC contract regarding fair treatment of workers, a safe work site environment, and decent conditions, including accommodation that is clean, warm and safe, and an adequate supply of food. These conditions will relate to TAP AG policies and relevant best practice recommendations of EBRD, Greek legislation and IFC. TAP AG will require the EPC contractor to inform workers about their rights and set-up a workers grievance mechanism and undertake surveys and focus group feedback interviews for early detection of
unsatisfactory situations. TAP AG will undertake compliance audits at the camps and worksites to check compliance with contractually required standards. TAP AG will set up a construction supervisory team that includes inter alia HSE officers, HR and CSR specialists.

Operation and Maintenance Phase:
The staff required for operation of the pipeline system in Greece will be less than 150 people. TAP AG’s operational staff will be employed according to TAP AG’s employment policies which will be in line with Greek and EU regulations regarding conditions of work. Staff will receive all required training to work in a safe environment. Any contractors maintaining the stations, patrolling the route or providing security of the installations will be contractually required to apply with TAP AG’s social and HSE requirements.

8.14 Community Health and Safety

8.14.1 Overview

The presence of the Project could affect the health and safety of the communities along the pipeline route and close to compressor stations as a result of worker-community interactions, the risk of injury associated with construction activities and competition for access to health care resources. Any community concerns or perceptions with regard to reduced health and physical safety by the community also need to be addressed.

The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the TAP Project on worker health and safety.

Box 8-14 Key Considerations for Assessment – Community Health and Safety

Sources of Impact/Risk
- Presence of the construction workforce of approximately 2,700 people sourced nationally and internationally who through interactions with communities may lead to increased disease transmission.
- The provision of health care for the workforce (both primary and secondary, i.e. hospital care) has the potential to affect access to health care for communities (due to competition for resources) with the potential for worsening health outcomes.
- Community members could be involved in accidents leading to injuries and even fatalities if they enter areas where construction activities are being undertaken.
Communities and stakeholders concerns around the safety of the pipeline once it is operational.

Changes to the environment due to increased noise, decreased air quality and changes to the visual environment as a result of the Project may affect health and wellbeing.

**Potentially Impacted Resources and Receptors**

- Communities along the pipeline route.
- Settlements close to compressor stations, logistic and construction camps.
- Primary health care facilities in communities along the route and towns with hospitals are in broader study area.

**Particular Baseline Conditions that are Potentially Influencing Impacts**

- Health care centres are located in larger settlements with villages being served by a health post with a doctor or nurse visiting on rotation (usually once a week). However, in TAP Greece East there are settlements that do not have a health post, nor are visited by medical staff. After the merging of health facilities, there is increased pressure on the existing services.
- Specialist health care facilities are provided to the residents of the TAP Greece East study area by 6 General Hospitals located in the nearby cities (Alexandroupoli, Komotini, Xanthi, Drama, Kavala and Serres). In almost all municipalities residents have to travel further than 4 km to the nearest hospital. Thessaloniki provides specialist health care facilities for the residents of central and western Macedonia (TAP Greece West).
- Non-communicable diseases such as circulatory diseases, hypertensions and cancer are amongst the leading causes of morbidity and mortality. There are high percentages of chronic illness throughout the study area.
- Infectious diseases are in decline in Greece, however, cases of tuberculosis, hepatitis A and vaccine preventable diseases do still occur. Cases of West Nile Virus have been reported in the study area between 2010 and 2012.
- Roma have lower vaccination coverage than the general population.
- Muslim people are considered to be more prone to delayed reference to health services, leading to more severe presentation of common illnesses (Key Informant interview, Department of Public Heath of East Macedonia – Thrace).
- As indicated by women focus groups (see Section 6.4.10 Safety and Security), children are permitted to play in the streets without adult supervision.

**Vulnerable Groups**

- Children
- Elderly
- Roma
- Muslim people

**References**

- Baseline is found in Section 6.4.9 and 6.4.10. Impact Assessment Criteria is found in Annex 5.8. Monitoring Measures are described in Section 9.2.

*Source: ERM (2012) and APROFOS (2013)*

The following table presents the key impacts of the TAP Project on community health and safety:
Table 8-86  Key Potential Impacts – Community Health and Safety

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased transmission of communicable diseases</td>
<td>Pipeline and/or operational compressor station safety</td>
<td>Increased transmission of communicable diseases</td>
</tr>
<tr>
<td>Increased pressure on health care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site trespass and Injury</td>
<td></td>
<td>Site trespass and Injury</td>
</tr>
</tbody>
</table>

Source: ERM (2012)

The origin of the workforce has yet to be established. This is an important factor as some source countries may have a higher prevalence of certain communicable diseases than Greece. If left unmanaged there is the possibility that there could be an increased incidence in local communities as a result of worker-community interactions.

Impacts are most likely to be experience close to construction camps, as listed in Table 8-87. Figure 8-29 and Figure 8-30 show the location of the camps and should be read in conjunction with the impact assessment.

Table 8-87  Construction Camps

<table>
<thead>
<tr>
<th>Camp</th>
<th>Location</th>
<th>District</th>
<th>Relevant Chainage (KP)</th>
<th>Staff approximately</th>
<th>Operational Duration</th>
<th>Distance to Nearest Village (approximately)</th>
<th>Distance to municipal capital (approximately)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Amfitriti</td>
<td>Alexandroupoli</td>
<td>0-65</td>
<td>150-200</td>
<td>12 months</td>
<td>Amfitriti 0.85 km</td>
<td>Alexandroupoli 5.5 km</td>
</tr>
<tr>
<td>2</td>
<td>Itea</td>
<td>Komotini</td>
<td>65-140</td>
<td>150-200</td>
<td>12 months</td>
<td>Itea 0.5 km</td>
<td>Komotini 4.4 km</td>
</tr>
<tr>
<td>3</td>
<td>Chalkero</td>
<td>Xanthi</td>
<td>140-224</td>
<td>150-200</td>
<td>12 months</td>
<td>Aspri Ammos 1.3 km</td>
<td>Kavala 4.8 km</td>
</tr>
<tr>
<td>4</td>
<td>Toumpa</td>
<td>Serres</td>
<td>224-294</td>
<td>150-200</td>
<td>12 months</td>
<td>Toumpa 1.1 km</td>
<td>Serres 15 km</td>
</tr>
<tr>
<td>5</td>
<td>Krithia</td>
<td>Lagada</td>
<td>294-359</td>
<td>150-200</td>
<td>12 months</td>
<td>Krithia 1.3 km</td>
<td>Thessaloniki 23.2 km</td>
</tr>
<tr>
<td>6</td>
<td>Paralimni</td>
<td>Pella</td>
<td>359-424</td>
<td>150-200</td>
<td>12 months</td>
<td>Paralimni 2.5 km</td>
<td>Giannitsa 6.5 km</td>
</tr>
<tr>
<td>7</td>
<td>Maniaki</td>
<td>Amyntaio</td>
<td>424-490</td>
<td>150-200</td>
<td>12 months</td>
<td>Antigonus 2.0 km</td>
<td>Amyntaio 6.0 km</td>
</tr>
<tr>
<td>8</td>
<td>Ampelokipi</td>
<td>Orestiada</td>
<td>490-543</td>
<td>150-200</td>
<td>12 months</td>
<td>Ampelokipi 1.2 km</td>
<td>Kastoria 7.3 km</td>
</tr>
</tbody>
</table>

Compiled by ERM (2012) and ASPROFOS (2013) from Logistics Concept for Greece (Doc. Ref. GPL00-ILF-100-F-TRP-0003 Rev 0C, dated 2011-08-33, prepared by ILF) and from Logistic Study Greece East (Doc. Ref. GPL00-WNT-100-F-TRP-0003 Rev 0D, dated 2013-04-19)

63 Final number and sighting of construction camps will be determined by the EPC contractor prior to construction.
Two construction camps are within a kilometer of a settlement. The Project will address impacts to these settlements through mitigation measures and management planning. However, it is not envisioned that these settlements will experience any additional impact over and above all other affected settlements.

Two additional camps will be constructed within the compressor station parcel and will house 350-400 workers. Their impacts are assessed within the scope of the compressor station.
Camp 1: Amfitriti

Camp population: 150-200 people
Timing of operation: 12 months
Environmental and social context: Located in agricultural land used to produce seasonal crops (wheat, cotton). The average size of settlement is 121 people.
Closest City: Alexandroupoli – 4.5 km
Closest settlement: Amfitriti – 0.8 km
Health concerns: Limited opportunity for transmission of communicable diseases. Rare but high impact pandemics such as influenza could spread rapidly if not effectively isolated.

Camp 2: Itea

Camp population: 150-200 people
Timing of operation: 12 months
Environmental and social context: Located in agricultural land used to produce seasonal crops.
Closest city: Komotini – 4.4 km  Closest settlement: Itea – 0.5 km
Health concerns: Greater possibility for workforce interaction with local communities and therefore higher potential of health risks. Rare but high impact pandemics such as influenza could spread rapidly to a larger population if not effectively isolated, especially due to proximity to Komotini.
Camp 3: Chalkero

**Camp population:** 150-200 people  
**Timing of operation:** 12 months  
**Environmental and social context:** Located in agricultural land close to Egnatia highway.  
**Closest City:** Kavala – 4.8 km  
**Closest settlement:** Aspri Ammos – 1.3 km  
**Health concerns:** Greater possibility for workforce interaction with local communities and therefore higher potential of health risks. Rare but high impact pandemics such as influenza could spread rapidly to a larger population if not effectively isolated, especially due to proximity to Kavala.

Camp 4: Toumpa

**Camp population:** 150-200 people  
**Timing of operation:** 12 months  
**Environmental and social context:** Located in agricultural land used to produce seasonal crops.  
**Closest city:** Serres – 15 km  
**Closest settlement:** Toumpa – 1.1 km  
**Health concerns:** Limited opportunity for transmission of communicable diseases. Rare but high impact pandemics such as influenza could spread rapidly to a larger population if not effectively isolated.

Camp 5: Krithia

**Camp population:** 150-200 people  
**Timing of operation:** 12 months  
**Environmental and social context:** Located in agricultural land used to produce seasonal crops.  
**Closest City:** Lagada – 12.3 km and Thessaloniki – 23.2 km  
**Closest settlement:** Krithia – 1.3 km  
**Health concerns:** Limited opportunity for transmission of communicable diseases. Rare but high impact pandemics such as influenza could spread rapidly to a larger population if not effectively isolated.
**Camp 6: Paralimni**

**Camp population:** 150-200 people  
**Timing of operation:** 12 months  
**Environmental and social context:** Located in agricultural land.  
**Closest city:** Giannitsa – 6.5 km  
**Closest settlement:** Paralimni – 2.5 km  
**Health concerns:** Greater possibility for workforce interaction with local communities and therefore higher potential for health risks. Rare but high impact pandemics such as influenza could spread rapidly to a larger population if not effectively isolated, especially due to proximity to Giannitsa.

**Camp 7: Antigonos**

**Camp population:** 150-200 people  
**Timing of operation:** 12 months  
**Environmental and social context:** Located in agricultural land.  
**Closest city:** Amyntaio – 6.8 km and Ptolemaida – 16 km  
**Closest settlement:** Antigonos – 2.0 km  
**Health concerns:** Greater possibility for workforce interaction with local communities and therefore higher potential for health risks. Rare but high impact pandemics such as influenza could spread rapidly to a larger population if not effectively isolated, especially due to proximity to Amyntaio.

**Camp 8: Ampelokipi**

**Camp population:** 150-200 people  
**Timing of operation:** 12 months  
**Environmental and social context:** Located in agricultural land close to A/D Siatistas Kristallopigis road.  
**Closest City:** Kastoria – 7.3 km  
**Closest settlement:** Ampelokipi – 1.2 km  
**Health concerns:** Limited opportunity for transmission of communicable diseases. Rare but high impact pandemics such as influenza could spread rapidly to a larger population if not effectively isolated.
8.14.2 Construction and Pre-commissioning Phase

8.14.2.1 Potential Impacts

8.14.2.1.1 Increased Transmission of Communicable and Vector Borne Diseases

The presence of a workforce living in open camps where interaction with nearby communities is possible could lead to the increased transmission of communicable diseases within these communities. The profile of these diseases will be influenced by the existing health profile of communities along the route and that of the workers. In addition, if opportunistic workers arrive in the area this could also impact on the transmission of communicable diseases. However, as discussed in Section 8.15 on community cohesion the risk of opportunistic workers is considered to be low. There is the potential for increased transmission between workers living and working in close quarters and then onwards into the communities through interaction. Vulnerable groups could be more affected due to their existing health profile.

Over the past decade there has been a number of influenza or respiratory disease pandemics including SARS, Avian Influenza and the H1N1 Virus (swine flu). Such outbreaks could occur during the construction phase of the Project and the movement of workers could provide transmission pathways and lead to the introduction of the disease into communities and to other workers along the pipeline route.

Other diseases that may be of concern include malaria (Greece implements a vector control programme annually but saw cases in 2011 for the first time since 1974), sexually transmitted diseases (which are discussed in more detail in the Section below), as well as vaccine preventable diseases such as measles and mumps, especially in vulnerable groups when vaccination coverage is lower.

8.14.2.1.2 Increased transmission of STD's

The presence of a workforce living in open camps along the pipeline route has the potential to lead to the increase in sexually transmitted diseases. This is a particular risk in relation to communities close to construction camps where the potential for interaction is highest. The
The prevalence of HIV/AIDS is currently low in Greece and therefore the potential for transmission will be influenced by the behaviour of the workforce.

Prostitution is legal in Greece with legal prostitutes needing to register with local government authorities and undergo health checks every two weeks, however, illegal prostitutes operate in Greece. Both legal and illegal prostitutes tend to be found in larger cities such as Athens and Thessaloniki. Legal or illegal prostitutes may also move to settlements or larger towns close to construction camps.

8.14.2.1.3 Increased Pressure on Health Care Facilities

The presence of a workforce along the pipeline route is likely to lead to increased pressure on the existing health care facilities in the broader study area and potentially decreased access for local communities. This is particularly the case for communities experiencing increased pressure on the existing services due to the merging of local health facilities. Any decrease in access to health care facilities including longer waiting times is likely to be associated with worse health outcomes. This is a particular risk in the case of incidents involving multiple casualties, or patients from both the workforce and community where hospital level care is required or in the case of a disease epidemic. Health care facilities that are most likely to face an increased pressure on the existing services due to an increase on health incidents from the construction of the Project are in smaller cities such as Alexandroupoli, Komotini, Xanthi and Drama.

8.14.2.1.4 Site Trespass and Accidents

There is a potential risk of site trespassing at work fronts for the duration of construction of the pipeline and all the facilities. Work fronts will not be fenced routinely although signage will be erected. The risk of trespassing is highest when work fronts are located closest to isolated houses or communities. Site trespassing could result in accidents leading to injuries or even fatalities since the presence of large pieces of machinery and open trenches for the construction of the pipeline, pose a particular risk if they were to become part filled with water. Young people and children are at most risk of getting injured since they are most likely to trespass onto construction sites.
8.14.2.1.5 Human Trafficking

Human trafficking usually takes the form of moving women and children against their will although men can also be subject to human trafficking. Greece is a receiving country for human trafficking mainly from Albania and Bulgaria. The government in Greece has recognised that human trafficking is an issue agreeing an Albanian–Greece Anti-Trafficking Pact for 2011-201364.

The likelihood of human trafficking increasing as a result of the Project is considered to be low due to the illegal nature of such activities, as well as due to the transient nature of the camps/work fronts.

8.14.2.1.6 Environmental Change

The construction of the pipeline, block valves and compressor stations will result in changes to the physical environment, which has the potential to affect the health and wellbeing of communities. Changes to the visual environment are likely to be minor and will mainly occur in forest or elevated areas where construction activities will be visible or will result in clearance of forests. The increase in dust is predicted to have a minor negative impact following mitigation but may still result in some increased annoyance and decreased wellbeing especially for residences closest to construction site e.g., less than 200 m from the construction and close to the compressor stations (further details can be found in Section 8.2). In terms of decreased air quality over the long term, impacts are expected to be minor at the compressor station site and therefore are unlikely to result in a recordable increase in respiratory diseases in the population.

The construction of the pipeline and the compressor station is likely to result in some temporary increased noise, mainly for residents within 150 m of construction sites. This increase in noise is likely to result in some annoyance and decreased wellbeing for those closest to the construction activities. However, this is likely to be minimised due to the hours of working. Sleep disturbance is unlikely due to the proposed hours of operation.

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Waste production as a result of the construction activities is unlikely to impact on the health of communities along the route due as opportunities for communities to come into contact with waste will be minimal as it will be stored in fenced areas.

8.14.2.2 Mitigation Measures

The following mitigation will need to be implemented to prevent impacts to community health and safety:

8.14.2.2.1 Worker Health Screening

- All employees of the TAP Project including employees of contractors and subcontractors will undergo employment screening after employment contracts are signed and the consent of the employee is provided, all according with Greek regulations and in compliance with provisions made in Greek laws 3850/210 and 3386/2005. No worker will be denied employment on the basis of the testing (as long as they are fit to work), but in the case of any infectious disease treatment will need to commence and the worker will need to be non-infectious before taking up their post. TAP AG will identify and approve clinics where employment screening can be undertaken. These clinics will be of an international standard. TAP AG will pay for the screening to be undertaken and the results will be confidential.

- Additionally, TAP AG will ensure that regular health screening will be provided to all workers in compliance with Greek laws.

8.14.2.2.2 Worker Behaviour

- TAP AG will extend the Worker Code of Conduct (which all TAP AG employees, contractors and subcontractors will follow) to include guidelines on worker-community interactions, alcohol consumption, intimate relationships/fraternisation with members of the local communities and explicitly forbid illegal activities including illegal substances.

- TAP AG and its contractors and subcontractors will as part of the induction process provide a consistent training session on the Worker Code of Conduct. All attendees must sign to confirm they have received and understood the training.
8.14.2.2.3 Education and Awareness Raising

- TAP AG and its contractors and subcontractors will as part of the induction process provide consistent training and education to all workers to ensure awareness of transmission routes and methods of prevention of communicable diseases as well as early symptoms of such diseases.

8.14.2.2.4 Health Care Provision

- Workers will be provided with primary health care and basic first aid at construction camps / worksites. This should be done in line with the IFC/ EBRD guidelines on worker accommodation summarised below:

**Box 8-15 Medical Facilities**

The guidance states that:

The availability or level of medical facilities provided in workers’ accommodation is likely to depend on the number of workers living on site, the medical facilities already existing in the neighbouring communities and the availability of transport. However, first aid must always be available on site.

The guidelines provide the following benchmarks:

1. A number of first aid kits adequate to the number of residents are available.
2. First aid kits are adequately stocked. Where possible a 24/7 first aid service/facility is available.
3. An adequate number of staff/workers are trained to provide first aid.
4. Where possible and depending on the medical infrastructures existing in the community, other medical facilities are provided (nurse rooms, dental care, minor surgery).

The contents of the first aid kits depend on the needs of the work-place but should include individually wrapped sterile adhesive dressings, individually wrapped eye pads, individually wrapped sterile wound dressings of various sizes, triangular bandages, safety pins and sterile gloves.

First Aid Rooms should include:

- a sink with hot and cold running water;
- drinking water and disposable cups;
- soap and paper towels;
- a store for first aid materials;
- foot-operated refuse containers, lined with disposable yellow clinical waste bags or a container for the safe disposal of clinical waste;
- a couch with waterproof protection, clean pillows and blankets;
- a telephone or other communication equipment; and
- a registration log for recording incidents where first aid has been given.

Source: IFC/ EBRD guidelines on worker accommodation August 2009
TAP AG will ensure that a capacity / needs assessment of equipment and personnel of hospitals along the route and in Thessaloniki is undertaken to determine if facilities have sufficient resources and equipment to deal with emergencies, particularly emergencies that have the greatest probability of occurring during construction, such as fractures and burnings. Agreements will be entered into with suitable hospitals to provide health care in emergency situations. These agreements will include provision of additional equipment or training for staff if required by TAP AG. TAP will ensure the hospital assessment is carried out by an EPC contractor and the agreement is in place prior to commencement of works.

TAP AG will develop Emergency Response Plans (ERPs) taking into account access to health care, major incidences, multiple casualty events and pandemics. These will be developed in consultation with national emergency providers and local health care facilities and will cover all contractors and subcontractors as well as consideration of the local community.

TAP AG will monitor the emergence of major pandemics through WHO alerts. When the WHO Pandemic Alert Scale reaches level 4 TAP AG will implement the relevant ERPs.

The Project will provide health care for any member of the community injured as a result of Project activities.

8.14.2.2.5 Community Safety

TAP AG will undertake a programme of stakeholder engagement and consultation to educate local communities of the risks of trespassing onto sites, the meaning of signs, the dangers of playing on or near equipment or entering fenced areas. This will include presenting in every primary and secondary school in communities along the pipeline route. A community meeting will also be given in every village along the route. Records of the meeting and attendees should be kept. As part of the schools meeting TAP AG will present on other issues such as construction methods, pipelines and skills required to work in construction to provide benefits.

TAP AG will ensure that signs are put up around work fronts and construction sites advising people of the risks associated with trespassing. All signs should be in Greek or in diagram form to ensure those with low levels of literacy understand the signs.

TAP AG will ensure that there is adequate fencing around pipe yards and other similar facilities to minimise the risk of trespassing. Fencing will be checked daily to ensure that it is in good condition and to look for any signs of entry.
When work fronts are within 100 m of an inhabited building, all equipment will be parked overnight in a demarcated area.

Security arrangements will be based on the UN Voluntary Principles for Security and Human Rights which represents international best practice. This involves e.g. selection based on a careful background screening of security forces, their training with regards to Human Rights and careful monitoring of their services. TAP AG will make security arrangements transparent to the local communities and consult with them regularly about the impact of arrangements on communities.

As part of its Environmental and Social Management System TAP AG will need to undertake Social Compliance Monitoring as part of its internal auditing and monitoring process.

In all contractor contracts the Project will make explicit reference to the need to abide by Greek law and policies.

8.14.2.2.6 Transport Routes

- Any trucking companies employed to work on the Project will have policies around health screening of their workers in line with Project requirements.
- All truck drivers who will work on the Project will receive mandatory training on safe driving, worker code of conduct and health awareness training.
- TAP AG will review routes and journey plans for the truckers, including likely stopping points or rest stops. TAP AG will provide details of the Grievance Mechanism at these locations.
- TAP AG will identify accommodation where workers will stay at points of entry and exit from Greece (if required) and will publicise details of the Grievance Mechanism at these locations.

8.14.2.2.7 Stakeholder Engagement

- TAP AG will undertake stakeholder engagement with affected communities and other stakeholders on a range of issues including changes to the visual environment, noise and social concerns including human trafficking. This engagement will take place during ESIA

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65A set of voluntary principles established to guide companies in maintaining the safety and security of their operations within an operating framework that ensures respect for human rights and fundamental freedoms.
disclosure and prior to the commencement of construction activities. Engagement will also take place during construction and prior to the commencement of operations. The stakeholder engagements activities and requirements are described in detail in the Stakeholder Engagement Plan.

- TAP AG will implement a Grievance Mechanism to address stakeholder concerns related to the Project in a timely manner.

8.14.2.3 Residual Impacts

<p>| Table 8-88 | Residual Impacts - Community Health and Safety – Construction Phase |</p>
<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Health and Safety</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Increased transmission of communicable diseases including STDs | - TAP AG has developed a Health & Safety Management policy where it sets out a clear commitment to ensuring the health and safety of all Project personnel, encompassing contractor personnel.  
- Adoption IFC/ EBRD guidelines regarding the construction and management of worker construction camps  
- TAP AG will ensure all workers including contractors and subcontractors undergo employment screening.  
- TAP AG will ensure all workers including contractors and subcontractors undergo regular health screening.  
- TAP AG will identify and approve clinics where employment screening can be undertaken.  
- TAP AG will ensure all workers including contractors and subcontractors receive education around transmission routes and symptoms of communicable diseases of concern.  
- TAP AG will develop ERPs with local emergency authorities and hospitals.  
- TAP AG will monitor WHO Pandemic Alert and implement appropriate ERPs if the alert level reaches 4.  
- TAP AG will extend the Worker Code of Conduct to include guidelines on worker –community interactions.  
- TAP AG will ensure that truck drivers receive health screening.  
- TAP AG will ensure that all truck drivers who will work on the Project receive the training on worker code of conduct and disease awareness training.  
- Communicable diseases are declining in Greece and as such the risk is mainly associated with the health profile and the behaviour of the workers.  
- Guidelines around worker community interaction should minimise the risk of close contact and therefore transmission.  
- In the event of a new epidemic measures will be in place to address this rapidly. As such the risk to the community is considered minor. | MINOR |

| Access to Health Care Facilities | TAP AG has developed a Health & Safety Management policy where it sets out a clear commitment to ensuring the health and safety of all Project personnel encompassing contractor personnel.  
- TAP AG will adopt IFC/ EBRD guidelines regarding the provisions of medical facilities at worker construction sites.  
- TAP AG will ensure basic health care for its workers is available and agreements with hospitals are in place following a needs assessment and upgrade support. | NOT SIGNIFICANT |
8.14.3 Operation and Maintenance Phase

8.14.3.1 Potential Impacts

8.14.3.1.1 Pipeline Safety

Communities along the pipeline route have expressed concerns over safety issues associated with the pipeline once it is operational. Particular concerns included risk of explosions, pipeline ruptures and gas leaks. While such concerns are generally unfounded due to the design of the pipeline (i.e. buried underground, restrictions along the working strip, safety measures and use of block valve stations) these could affect community wellbeing and their perception of the safety of the area.
8.14.3.1.2 Environmental Health

During the operational phase of the Project the compressor stations will increase noise levels and affect the local air quality (increased emissions of NOx) within their vicinity. However at the emissions levels predicted, and the remote location of CS00 and CS01, impacts to health are likely to be not significant. Changes to the visual environment associated with the presence of the compressor station may also affect the mental wellbeing of residents of nearby communities. However, vegetation screening will significantly mitigate any visual negative impact (see Section 8.6).

The operation of the pipeline and BVSs will not generate any significant air or noise emissions. Long-term changes to the landscape and visual amenity along the pipeline route will be limited to the presence of the aboveground, permanent structures (i.e. BVSs). However, it is not expected that these will have any impact on the wellbeing of residents of nearby communities.

8.14.3.2 Mitigation Measures

The following mitigation will need to be implemented to avoid impacts to community health and safety:

- TAP AG will undertake stakeholder engagement regarding the operation of the compressor stations, of the pipeline and BVSs. This will be undertaken prior to the commencement of the construction phase.
- TAP AG will maintain the Grievance Mechanism throughout the operation of the pipeline so stakeholders can report specific concerns.
- TAP AG will undertake a community education programme on pipeline safety to alleviate concerns. This will include a programme of open community meetings at settlements along the route prior to the completion of construction.
- TAP AG will have the compressor station permanently guarded, while the pipeline route will be regularly patrolled by staff in helicopters, vehicles or on foot to deter deliberate damage or vandalism and assure the operational safety of the Project is not compromised.
Further measures implemented during the design and installation of the pipeline will also minimise impacts to community health and safety during operation, such as, pipeline corrosion protection and pipeline wall thickness controls.

8.14.3.3 Residual Impacts

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Health and Safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipeline Safety</td>
<td>• TAP AG will maintain the Grievance Mechanism.</td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>• TAP AG will undertake a community education programme on pipeline safety to alleviate concerns.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TAP AG will guard the compressor station facility and patrol the pipeline route to deter deliberate damage or vandalism.</td>
<td></td>
</tr>
<tr>
<td>Environmental Health</td>
<td>• TAP AG will undertake stakeholder engagement around the long term impacts of the compressor stations.</td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td></td>
<td>• TAP AG will maintain the Grievance Mechanism.</td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012) and ASPROFOS (2013)

8.14.4 Decommissioning Phase

8.14.4.1 Potential Impacts

During the decommissioning phase there is potential for impacts to occur related to worker community interactions including transmission of communicable diseases and sexually transmitted diseases, decreased access to health care and the potential for site trespassing and accidents. These impacts will reflect those outlined in the construction phase.

In terms of environmental impacts on health for air quality, noise and changes to the visual environment these will reflect the construction phase.
8.14.4.2 Mitigation Measures

In relation to decommissioning mitigation will need to be as per the construction phase covering the following topic areas:

- Worker Health Screening;
- Worker Behaviour/Code of Conduct;
- Education and Awareness Raising;
- Health Care Provision;
- Community Safety;
- Transport Routes; and
- Stakeholder Engagement.

8.14.4.3 Residual Impacts

Residual impacts along with mitigation measures and significance of impact as per Construction phase (see Table).

8.14.5 Summary of Impacts on Community Health and Safety

A large infrastructure project like TAP bears a potential for a number of public health and safety risks for the communities along the pipeline route and around the compressor stations. Key risks during construction *inter alia* relate to construction workforce - community interactions, such as workers misbehaving, spread of communicable diseases including sexually transmitted diseases (STDs), increased accident risks caused by the substantial construction logistics and transports, by construction site trespassing, competition for access to health care, strain on local resources and environmental change.

TAP AG will undertake a number of international best practice management measures to address the various public health, safety and security risks involved with the presence of a large workforce and the construction activities. Contractors will be required to comply with strict requirements and safeguards. This includes *inter alia* setting up of a *Workers Code of Conduct*.
and mandatory health awareness training for workers as part of their induction, health screening of workers, provision of health facilities in the camps (primary health care and basic first aid).

In addition to the above TAP AG will develop *Emergency Response Plans* (ERPs) taking into account access to health care, major incidences, multiple casualty events and pandemics. These should be developed in consultation with national emergency providers and local health care facilities and will cover all contractors and subcontractors as well as consideration of the local community.

In order to reduce the risk of accidents a *Traffic Management Plan* will be developed and drivers of trucks and construction equipment will need to be qualified, be able to demonstrate reasonable health and fitness, and undergo HSE training. Warning signage will be erected and information meetings will be held with the local population to avoid site trespassing during construction.

By applying the above mentioned mitigation measures, significance of impacts to health and safety will become minor since the duration of any of those impacts is also likely to be temporary.

A *Grievance Mechanism* will also be available to the local population and the Project’s *Community Liaison Officers* will be on site to address any community health, safety and security issues raised, with immediate effect. The Project will ensure health care is provided to any member of the community injured as a result of Project activities.

Public Health and Safety during operation has been considered in the design of the facilities and the risk assessments undertaken. The Project includes built-in safety features according to established European standards and norms for pipeline systems. In order to address the handling of residual risk associated with non-routine events during operation, TAP AG will develop an *Emergency Response Plan* (ERP) that will specify the actions required in case of an incident.

The ERP for operation will be developed according to Greek and EU requirements and international industry standards and best practice. The Emergency Response Plan will be consulted with the competent authorities, emergency services/civil defence and the municipality administrations along the pipeline route. Based on consultations with relevant stakeholders, TAP AG will investigate the capacity of statutory local and regional emergency response providers to
participate in emergency response activities. TAP AG or selected contractor will provide necessary training, engage in the organisation of drills and exercises, and if needed, TAP AG will also provide for necessary improvements to equipment e.g. of local fire brigades / civil defence units. Households in communities in the vicinity will receive information via leaflets which advise how to behave in case of a pipeline leak or incident.

During Operation, the Project installations will be guarded by security personal which will either be TAP staff directly, or supplied by a security company. The compressor station will be permanently guarded, while the pipeline route will be regularly patrolled. TAP AG is committed to address the topic of facility security and potential implications for public security according to national Greek requirements and in accordance with the Voluntary Principles on Security and Human Rights which are considered international best practice in this field.

Significance of impacts to health and safety during operation will therefore be minor by applying all abovementioned mitigation measures.

8.15 Community Cohesion

8.15.1 Overview

The term community cohesion refers to the quality and quantity of interactions between members of a community (intra-community) and between different communities (inter-community). It describes the capacity to function and develop together, based on integration and the ability to manage conflicts within the community/between neighbouring communities. Community cohesion has to be considered as a continuous process interweaving a broad background fabric of issues such as access to education and employment, poverty and social inequalities, social and cultural diversity, access to communication and information. A high level of community cohesion will implicate respect for persons as individuals, sensitiveness to ethnic and social differences and a sense of belonging to the community/to a local set of communities.

A change in the overall socioeconomic setting of an area by a new project is likely to influence relationships among community members and between different communities, resulting in, for example, heightened tensions which will affect the complex fabric of community cohesion on the community and inter-community level. The following box shows the key sources of impact,
potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the Project on community cohesion.

Box 8-16  Key Considerations for Assessment– Community Cohesion

Sources of Impact/Risk
- Up to 2,700 workers may be brought into the area during construction phase.
- There may also be influx of opportunists looking to benefit through employment or other economic opportunity as a result of the Project.
- Community expectation of project benefits high and unlikely to match the reality.
- Potential for heightened tension between and within community as a result of changes due to project related activities.

Potentially Impacted Resources and Receptors
- Communities located adjacent to the Project site.

Particular Baseline Conditions that are Potentially Influencing Impacts/Risks
- Potential tensions on the local level between formal community leaders and influential, individuals, or groups of local people.
- Unemployment in all regions of the study area significantly higher than national average;
- A large proportion of the unemployed are young people under 25 (in Emmanouil Pappa, Irakleia, Pella and Erdoea municipalities over 60% of unemployed people are under 25);
- High percentage of people who have only completed primary school; 21-22% in TAP East section and 10-15% in TAP West section either do not complete primary school or are illiterate;
- “Low educational, social and economic levels do not allow people to exploit opportunities” (key informant voice, Kastoria Municipality);
- Information about conflict and hostility between local communities and Roma camps (permanent camp close to Nea Messimvria, temporary camps close to Pella); Also information from key informant interviews and Roma focus groups about suspicion of local communities towards Roma and conflicts between different Roma groups.
- Negative experience from past infrastructure projects;
- Current economic situation is impacting on the general feeling of anxiety and negativity.

Project Factors that are Potentially Influencing Impacts/Risks
- Type and management of worker housing including level of interaction, Project facilities (e.g. recreational activities), and whether housing is a mixed or isolated development.
- Manner in which the Project interacts with communities, particularly transparency of information provision by the Project and inclusivity of engagement.
- Management of impacts including compensation for land; management of the Social and Environmental Investment Program.

Vulnerable Groups
- Roma groups living permanently or temporary in the study area;
- Economic immigrants might become vulnerable in the context of intra-community tension, resulting in discrimination and exclusion.

References
- Baseline is found in Sections 6.4.2, 6.4.3 and 6.4.4. Impact Assessment Criteria is found in Annex 5.8. Monitoring Measures are described in Section 9.2.

Source: ERM (2012) and ASPROFOS (2013)
The following table presents the key impacts of the Project on community cohesion during the key project phases.

### Table 8-90 Key Potential Impacts – Community Cohesion

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influx of workers</td>
<td>Risk of heightened tensions within and between communities.</td>
<td>Resentment between communities over isolated benefits from decommissioning.</td>
</tr>
<tr>
<td>Unmet expectation for benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk of heightened tensions within and between communities maybe due to: poor community leadership, inequitable distribution of benefits, or changes in services, infrastructure and other resources.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012)

#### 8.15.2 Construction and Pre-commissioning Phase

#### 8.15.2.1 Potential Impacts

##### 8.15.2.1.1 Influx of Workers

Workers will be brought into the vicinity of Project activities through a managed process of recruitment and transportation. Workers will mostly be accommodated in self-contained camps and will be subject to a Code of Conduct with regard to their behaviour and conduct towards local people. Further information with regard to these measures is provided in Section 8.14.

In addition to the directly hired project labour, it is also possible that people could move towards project locations in the hope of finding work directly with the Project or to gain benefit from the indirect economic opportunities that the Project may bring, such as selling goods or services to the Project or its workforce. Such influx will be unmanaged and, should it be significant, is likely to pressurise the limited services and infrastructure in the local settlements. A high degree of influx could result in other effects such as inflation, social tensions, and changes to behavioural norms. However, such a scale of influx will be unlikely for a project such as TAP with its relatively short construction phase and proactive recruitment and local content measures (priority for local workers; offsite recruitment; etc.).
8.15.2.1.2 Unmet Expectations for Benefits

There is a high degree of expectation in Greece that the Project will bring local, as well as national level benefits to the country; issues related to project related benefits consisted of 40% in TAP Greece East section and 23% in TAP Greece West section of all issues raised by stakeholders during the local level engagement (see Section 7). The main expectations for benefit include employment, access to gas and social investment projects from the Project. However, there is some scepticism due to poor experience from past infrastructure projects in the study area. In this context, loss of livelihoods, land compensation, depreciation and building restrictions are major concerns.

TAP AG has committed through its policy on Corporate Social Responsibility (TAP-HSE-PO-0002) to optimise the benefits that may be brought by the Project through infrastructure enhancement and local content and through the delivery of a Social and Environmental Investment Program (refer to Section 9 for further details). Although the statements embedded within these documents demonstrate a high degree of Project commitment in the delivery of benefits, there remains a strong likelihood of unmet expectations in the local communities due to the following:

- **The timing of information provision**: Communities are anxious to understand the nature of the benefits that they will receive through the social and environmental investment program. This detail is only likely to be available as the project moves into construction.

- **The scale of impacts**: The level and duration of employment during construction, even with a very well implemented local content strategy, will be very limited. Operational workforce numbers are limited. With regard to social and environmental investment, whilst a well implemented program should provide some tangible improvements, they will be discrete and may not meet the expectations of local communities.

- **Access to gas**: The Project is not currently planned to provide gas to the local market.

- Unmet expectations could result in a reduction in local acceptance of the Project as it moves into the construction phase, which if unmanaged, could present a risk of Project delays.
8.15.2.1.3 Heightened Tensions within and between Communities

Infrastructure projects often raise tensions within communities (intra-community tension) or between communities (inter-community tension). The causes of such tensions may be many, and possibly include the following:

- Poor leadership, which at its worst may consist of fraudulent behaviours by those with power, but more commonly consists of poor communication of information with regard to the Project and lack of engagement with the community;
- Inequitable distribution of benefits, or a perception of this; or inequitable distribution of negative impacts, or perception of this;
- Changes in services, infrastructure and other resources (e.g. forest resources) which may be altered by the Project or by indirect effects; and
- The simple stress of change and of interacting within the community and with the Project. Often factors such as short timelines for decisions, lack of information, or lack of clarity of such information exacerbate these tensions.

In the context of Greece, the level of existing stress is currently high, due to the overall economic situation of the country, resulting in general feelings of anxiety and negativity. However, community cohesion is generally good throughout the study area, with conflicts within settlements and between communities being rare.

There are some settings where the Project, due to the reasons stated above, could raise or increase tension between different migrant groups in the study area. Cases of discrimination or exclusion raised in focus groups with economic immigrants were minor, currently untroubled relations between Greeks and economic immigrants might change. Still, tensions are more likely to be directed at the Project rather than at others within communities; however, it is unclear whether conflicts between and within settlements or between different groups will emerge as the project progresses and community investment is implemented.

Roma are considered a vulnerable group within the study area as they are often excluded from decision-making and information sharing processes. As stated above, additional tensions may arise if communities believe that they are not receiving adequate project benefits, and they
perceive that the Roma groups in the study area are receiving preferential or special attention through direct engagement as part of the consultation process.

8.15.2.2 Mitigation Measures

The effective management of the impacts of the Project is the fundamental basis for minimising the potential for impacts to community cohesion. These are presented in other Sections of this assessment and are underpinned by a set of comprehensive policies that have been adopted by TAP AG. The following measures, which are mainly drawn from the TAP Strategy for Stakeholder Engagement (TAP-HSE-ST-0009), seek to realise an effective two way channel of communication between the Project and the local communities during the construction period. They are underpinned by the TAP Policy on Corporate Social Responsibility (TAP-HSE-PO-0002) which is summarised in Box 8-17.

Box 8-17 TAP AG Commitments to Transparency, Accountability and Stakeholder Engagement

1. TAP AG complies with international standards on transparency, accountability, anti-corruption, human rights and national laws and regulations (for example the 10 principles of the United Nations global compact.) TAP AG will manage its security activities and relationships according to the voluntary principles on security and human rights.

2. TAP AG identifies individuals, households, communities and other entities that may be affected by the project as well as other stakeholders (Regulative bodies, local governments, NGOs, etc.).

3. TAP AG engages these stakeholders in discussions on social, environmental, safety, security and other relevant issues such as regular, free, prior and informed consultations. TAP AG pays particular attention to disadvantaged, marginalised, vulnerable and/or poor populations and tailors the consultation process around their preferences.

4. Relevant project information in particular those related to environmental and social impacts, health and safety hazards emergency management will be disclosed at the local level in a manner that is accessible, understandable and culturally appropriate for those affected.

5. TAP AG assures through the supply chain full compliance with the core labour standards as defined by the International Labour Organisation. TAP AG’s workforce will benefit in addition from equal opportunities, a non-discriminatory workplace, and best practice on human resource management, occupational health and safety.

6. TAP AG will establish an independent grievance redress mechanism to address grievances, complaints and reports of non-compliance in a timely, impartial and transparent manner.

Compiled by ERM (2011)
8.15.2.2.1 Stakeholder Engagement during the Construction Phase

Through different communication and engagement methods, stakeholders in the immediate vicinity of the construction works will be kept informed about the planned activities, timelines, potential impacts and changes to schedules, if any. Stakeholders should be made aware of whom to address and how to raise any concerns or grievances. This will include the following:

- The ESIA will be publicly disclosed and discussed at the settlement level, even though not required by the Greek law, providing information with regard to impacts and benefit.
- The Social and Environmental Investment Plan and a summary of the Livelihoods Restoration Framework will be publicly disclosed and discussed at the settlement level, also providing information with regard to the benefits from the Project.
- Project update leaflets will be prepared and widely distributed from six month prior to construction until the end of the construction phase. These information releases will emphasise the limited nature of employment and the recruitment processes and the progress of the Social and Environmental Investment Plan. Oral presentations of updates by the community liaison officers will be held in order to address illiterate community members.
- TAP AG will maintain a community relations team that will include one community liaison officer at each construction camp location during construction activities. They will proactively and regularly engage with the local stakeholders prior to construction activities, providing updates and answering their queries. They will be present on the ground during the whole construction process and available to the affected communities.
- The Grievance Mechanism is adjusted to the Project construction phase with the relevant contractor and sub-contractor staff fully aware of their roles. The aim of this is quick and effective response to the concerns raised by local stakeholders and the provision of additional resources if necessary to resolve concerns within stipulated timescales.
- The commitments that are encapsulated in the Project documents including this ESIA, the LRF and the SEI will be included in the ESMMP, which is designed to ensure the implementation of all commitments as the Project progresses through its various stages.
- The Project will communicate to affected stakeholders the progress on meeting the Project’s environmental and social commitments during the construction phase through the release of performance reports which will be posted on the Project website.
- The Project will commission third party monitoring, which might involve local stakeholder representatives, in assessing whether social and environmental impact mitigation...
measures and other intended benefits are as effective as anticipated. The reports of the third party monitoring will be made available to the public through the TAP website.

- Meeting minimum standards for stakeholder engagement and social performance will be used as one of the selection criteria for the main contractors.

- Communities will be engaged in the preparation of the social and environmental investment activities to be taken forward in the vicinity of their communities. They will then be kept informed on the progress of such activities and opportunities for their involvement will be maximised.

- Engagement process will be inclusive and all vulnerable groups (Roma, immigrants) will be attended to and informed. Separate meetings will be held with Roma communities prior to and during the construction activities in the local area to identify and manage any specific issues.

8.15.2.3 Residual Impacts

Table 8-91 Residual Impacts – Community Cohesion – Construction Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influx of workers</td>
<td>As for economy and employment mitigation:</td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td></td>
<td>- The Employment Strategy will define target locations for recruiting local unskilled labour for each of the fourteen working spreads.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- The Employment Strategy will outline and require a fair and transparent recruitment process for all openings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- The Project will provide clear information on the number and limited timescales of employment opportunities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- The Project will release project update leaflets from six months prior to construction until the end of the construction phase. These information releases will emphasise the limited nature of employment and the recruitment processes and the progress of the Social and Environmental Investment Plan.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unmet Expectations for Benefits</th>
<th></th>
<th>MODERATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Realisation of the TAP Social and Environmental Investment Strategy in line with CSR Policy objectives.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communities will be engaged in the preparation of the social and environmental investment activities to be taken forward in the vicinity of their communities. They will then be kept informed on the progress of such activities and opportunities for their involvement will be maximised.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Project will release project update</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact / Risk</td>
<td>Measures to Address the Impact / Risk</td>
<td>Significance of Residual Impact/ Risk</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Community Cohesion</td>
<td>leaflets from six months prior to construction until the end of the construction phase. These information releases will emphasise the limited nature of employment and the recruitment processes and the progress of the Social and Environmental Investment Plan. Illiterate community members will be informed through the community liaison officers.</td>
<td>of importance to all stakeholders.</td>
</tr>
</tbody>
</table>
| Heightened tensions within and between communities| • The ESIA, a summary of the Livelihoods Restoration Framework and the Social and Environmental Investment Plan will be disclosed and discussed at the settlement level providing information with regard to impacts and benefits.  
• Project update leaflets will be distributed from six months prior to construction until the end of the construction phase. These information releases will emphasise the limited nature of employment and the recruitment processes and the progress of the Social and Environmental Investment Plan.  
• TAP AG will maintain a community relations team that will include one community liaison officer at each work front location during construction activities.  
• The Grievance Mechanism will be adjusted to the Project construction phase with the relevant contractor and sub-contractor staff fully aware of their roles in third party grievance resolution process; additional resources if necessary to resolve concerns within stipulated timescales.  
• The ESMMP will ensure that Project commitments are carried out.  
• The Project will release performance reports which will be posted on the project website.  
• The Project will commission third party monitoring, which might involve local stakeholder representatives, in assessing whether social and environmental impact mitigation measures and other intended benefits are as effective as anticipated. The reports of the third party monitoring will be made available to the public through the TAP website.  
• Meeting minimum standards for stakeholder engagement and social performance will be used as one of the selection criteria for the main contractors.  
• Communities will be engaged in the preparation of the social and environmental investment activities to be taken forward in the vicinity of their communities. They will then be kept informed on the progress of such activities and opportunities for their participation. | MINOR  
• Local communities and other stakeholders will be well informed.  
• Regular engagement and presence of the CLOs will help to identify concerns rapidly before they escalate and result in community tensions.  
• The Grievance Mechanism will be available for individuals and, well managed, should also assist in identifying and resolving problems. |
Community Cohesion

- Involvement will be maximised.
- Separate meetings will be held with Roma communities within the 2 km corridor prior to construction and during the construction activities in the local area to identify and manage any specific issues.

Source: ERM (2012)

8.15.3 Operation and Maintenance Phase

8.15.3.1 Potential Impacts

As the Project transitions to operations, the causes of impacts to community cohesion will subside as the majority of construction activities cease. However, the transition period from the construction to the operations phase requires careful management in order to maintain an ongoing dialogue with stakeholders despite possible change of community liaison personnel and reduction in overall workforce. Resentment between communities may arise due to the perception of receiving reduced care and attention in the context of stakeholder engagement. The suspension of local construction workforce on the one hand and the employment of operational staff (though limited in number) might also result in resentment between communities and between the communities and the Project.

8.15.3.2 Mitigation Measures

TAP AG will implement and conduct the following stakeholder engagement measures during operations:

- Reduction and / or replacement of community liaison officers will be carefully management during the transitioning of construction to operation in order to maintain the knowledge and relationships built between project representatives and local stakeholders until this point and ensure continuity. Retaining the same community liaison personnel or ensuring overlap between outgoing and incoming teams for successful knowledge transfer will be considered during this period. Stakeholders will be kept informed about changes that will impact them.
due to transfer to the operations phase. Commitments made to stakeholder relevant to the operations phase will be integrated into operations phase management systems and functions.

- The Project will continue to engage with stakeholders through a combination of meetings, focus groups, questionnaires, suggestion boxes, etc. The plan for stakeholder engagement for the operations phase will be finalised six months prior to the transition to operations and shared with key stakeholders. The plan will also be posted on the Project website.

- Stakeholder information will be reviewed on at least an annual basis to reflect changes in leadership, the emergence of new groups or shift in concerns or influences of existing ones.

- The communications mechanism and its success will be reviewed annually for effectiveness and the stakeholder engagement plan will be revised to take into account the results of the review.

- An annual report will be prepared and publicly disclosed. It will include meeting ESIA and other commitments, changes to Project design or operational procedures with potential impacts on certain stakeholder groups, any unforeseen changes, regular maintenance procedures, emergency response plans and safety and security requirements, and social and environmental investment activities and outcomes. The coverage of different issues will be proportionate to the extent of Project impacts and stakeholder interests.

- The Project commitments including those in the ESIA and the LRF and SEI will be encapsulated in the ESMMP which will ensure their implementation as the Project progress through its various phases.

- The Grievance Mechanism will remain in place and regularly communicated to stakeholders.

- The Project will involve project affected stakeholders or third party representatives in monitoring of the Project’s social and environmental performance for issues of great interest to the public.
8.15.3.3 Residual Impacts

### Table 8-92: Residual Impacts – Community Cohesion – Operation Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| Resentment between communities over inequitable distribution of stakeholder engagement activities | • Reduction and/or replacement of community liaison officers will be carefully managed in order to maintain the knowledge and relationships built between project representatives and local stakeholders until this point and ensure continuity.  
• Commitments made to stakeholders relevant to the operations phase will be integrated into operations phase management systems and functions.  
• The Project will continue to engage with stakeholders through a combination of meetings, focus groups, questionnaires, suggestion boxes, etc.  
• The plan for stakeholder engagement for the operations phase will be finalised six months prior to the transition to operations and shared with key stakeholders. The plan will also be posted on the Project website.  
• An annual report will be prepared and publicly disclosed. It will include meeting ESIA and other commitments, changes to Project design or operational procedures with potential impacts on certain stakeholder groups, any unforeseen changes, regular maintenance procedures, emergency response plans and safety and security requirements, and social and environmental investment activities and outcomes.  
• The Project commitments including those in the ESIA and the LRF and SEI will be encapsulated in the ESMMP which will ensure their implementation as the Project progress through its various phases.  
• The Grievance Mechanism will remain in place and regularly communicated to stakeholders.  
• The Project will involve project affected stakeholders or third party representatives in monitoring of the Project’s social and environmental performance for issues of great interest to the public | MINOR  
• Continuity of relations between communities and community liaison personnel will be ensured  
• The Stakeholder Engagement Plan for the operations phase will help to build trust in continuity of engagement activities  
• The Grievance Mechanism will remain in place, and, well managed, should assist in identifying and resolving problems |
| Resentment between communities over inequitable provision of local employment | • Social and environmental investment activities will continue after construction  
• The Project will continue to engage with stakeholders through a combination of meetings, focus groups, questionnaires, suggestion boxes, etc.  
• Weeks prior to the end of construction, the Project will release an information leaflet (as one issue of the regular update leaflets), with a focus on the coming end of construction with clear explanation of the respective consequences for local construction workforce  
• Clear and transparent communication of the limited local employment options for the operation phase  
• The Grievance Mechanism will remain in place and regularly communicated to stakeholders. | MINOR  
• Local communities will be well informed  
• Employment for operation will be limited  
• The Grievance Mechanism will remain in place, and, well managed, should assist in identifying and resolving problems |

Source: ERM (2012)
8.15.4 Decommissioning Phase

The decommissioning impacts will be similar to those during the construction phase, as outlined above depending on the chosen strategy at the time.

8.15.4.1 Mitigation Measures

TAP AG will conduct a decommissioning impact assessment. Key elements of the decommissioning impact assessment will be:

- Engagement with communities prior to closure to inform local settlements of the timeframe and likely impacts resulting from decommissioning;
- Assessment of the current baseline conditions and of predicted project impacts;
- Identification of vulnerable groups;
- Design and implementation of mitigation measures; and
- Monitoring and evaluation of implementation.

8.15.4.2 Residual Impacts

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact/ Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Cohesion</td>
<td>A decommissioning impact assessment will be undertaken prior to closure to consider issues and specific mitigation measures will be considered.</td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td>Issues relating to community cohesion from decommissioning</td>
<td>Knowledge gained through construction and operation should allow the Project to manage decommissioning effectively.</td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012) and ASPROFOS (2013)

8.15.5 Summary of Impacts on Community Cohesion

Large infrastructure projects like the Project bear the social risk that community members or whole communities feel potentially disadvantaged when there are different individual perceptions
about the distribution of benefits and burdens during project implementation. This may lead to frictions and impact on community cohesion. Consultation outcomes during ESIA preparation have shown that strong community expectations towards the Project exist, in particular with regards to employment during construction and operation, and regarding other potential community benefits.

Project implementation will result in a temporary planned influx of workforce to the project area composed of up to 2,700 workers. Only a limited number of the workforce will be hired locally from the project area. Workers will mostly be accommodated in self-contained camps and will be subject to a Code of Conduct with regard to their behaviour and conduct towards local people. In addition there is the potential that opportunity seekers for jobs and provision of goods and services will influx to the area, mainly in vicinity of the construction camps.

Potential community cohesion issues will be proactively addressed by TAP AG through a set of measures which include the following main elements:

- TAP AG via its contractors will apply proactive recruitment and local content measures which will strive to provide opportunities in the local context.
- Land issues will be managed through the Land and Easement Acquisition (LEA) process, which creates transparent and equal management of impacts for communities and affected landowners/users. Should livelihoods be affected, impacts will be managed through a Livelihood Restoration Framework (LRF).
- Further, TAP AG has committed through its policy on Corporate Social Responsibility to optimize the benefits that may be brought by the Project through infrastructure enhancement and local content and through the delivery of a Social and Environmental Investment Program (SEI). Implementation of the SEI programme will aim to distribute benefits in a transparent and fair way and with equal opportunities for the communities in sharing benefits. The SEI will be developed in consultation with the communities and this will take into account vulnerable and marginalised groups in the population.
- The Project commitments including those in the ESIA and the LRF and SEI will be encapsulated in the ESMMP which will ensure their implementation as the Project progress through its various phases.
- TAP AG will implement a Grievance Mechanism to address individual and community concerns related to project impacts, in particular during construction.
8.16 Traffic and Transport

8.16.1 Overview

While construction traffic will be significant, operation and maintenance will not be of any significant magnitude. Box 8-18 shows the key sources of impact, potentially impacted resources and receptors, and the baseline and project influencing factors associated to the impacts of the Project related to traffic and transport.

Box 8-18 Key Considerations for Assessment – Traffic and Transport

Sources of Impact/Risk

- Construction Phase: Construction vehicles, heavy plant, transportation of materials and goods to pipe yards and worksites (of particular note: large quantities of pipe section and padding materials and heavy bulky items for the compressor stations,) and transporting workers to/from camps.
- Operation Phase: Service- movement of servicing and maintenance vehicles.
- Decommissioning Phase: Depending on the decommissioning concept, the impacts could be similar in nature to the construction phase.

Potentially Impacted Resources and Receptors

- Road Users (vehicle users, pedestrians and cyclists)
- Local population along the logistics road corridors
- Note: potential impacts to air quality, acoustic environment and habitats are addressed in Sections 8.3, 8.4 and 8.8, respectively.

Particular Baseline Conditions that are Potentially Influencing Impacts/Risks

- Size and condition of existing roads: mostly good road infrastructure along the route
- Current numbers of vehicle movements on the existing road network (and the potential daily and seasonal variations)
- Present traffic bottlenecks and accident hot-spots

Project Factors that are Potentially Influencing Impacts/Risks

- Exceptional night-time driving of long, wide and heavy loads for Compressor Station components

References

- Baseline is found in Section 6.4.7. Impact Assessment Criteria is found in Annex 5.8. Monitoring Measures are described in Section 9.2.

Source: ERM (2012)
Table 8-94 presents an overview of the key impacts of the Project traffic and transport activities during the main phases.

Table 8-94 Key Potential Impacts – Traffic and Transport

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Construction traffic may cause significant numbers of traffic movements by mainly heavy vehicles on top of existing traffic.</td>
<td>• Very low levels of traffic generated during operation – no significant impacts predicted</td>
<td>• The impacts and mitigation will be similar as for the construction phase (depending if the pipeline remains in the ground or is recovered)</td>
</tr>
<tr>
<td>• Potential for hindrance to road users on smaller junctions and local roads.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Increased accident risks at traffic nodes and in heavily used by the project logistics and routes through settlement.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Impacts will be within the foreseen one year of construction and occur in peaks along the construction spreads.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012)

8.16.2 Construction and Pre-commissioning Phase

8.16.2.1 Potential Impacts

8.16.2.1.1 Traffic Generated During the Construction Phase

The traffic and transportation requirements during construction are based on the Logistics Report GPL00-ENT-100-F-TRP-0003 Rev.: 0A and Logistics Concept for Greece GPL00-ILF-100-F-TRP-0003 Rev.: 0C). The logistics of delivering materials such as components of the Compressor Stations, special construction equipment and pipes (in case they are not produced in Greece) shall initially be handled through the port system of Northern Greece. The main port in Northern Greece is the port of Thessaloniki, located in Central Macedonia, which has effective loading and unloading capacities and easy access via the primary road network to Central, Eastern and Western Macedonia.

Smaller ports adjoining the pipeline route are the port of Alexandroupolis, which is the closest to the pipeline section in Greece East and the port of Kavala. Three Pipe Yards (PY) for storing pipes and equipment are situated close to the ports of Alexandroupolis, Kavala and Thessaloniki. The pipes shall be transported with regular trailers or telescope trailers from the ports to the main
PY and further to the PY’s located along the pipeline route. Transport from the PY’s shall be made by stringing trucks or with special transport vehicles in mountainous regions.

In total 8 camps and 17 pipe and bending yards are foreseen (*Logistic Report GPL00-ENT-100-F-TRP-0003 Rev.: 0A and Logistics Concept for Greece GPL00-ILF-100-F-TRP-0003 Rev.: 0C*) along the Greece pipeline route, located at regular distances in order to optimize transport distances.

An overview of the transport requirements is illustrated by the following:

- For the section Kipoi - Amaranta (115 km length) approximately 6,500 pipes will need to be delivered to the construction site. This corresponds to approximately 3,200 lorry loads (one-way) from the port of Alexandroupolis to the main pipe yard in the vicinity of the port and furthermore to the pipe yards and to the construction site, i.e. approximately 6,400 truck trips (out and return).

- For the section Iasmos - Serres (165 km length) almost 9,300 pipes will need to be delivered to the construction site. This corresponds to approximately 4,600 lorry loads (one-way) from the port of Kavala to the main pipe yard close to the port and from there to the pipe yards and construction site i.e. approximately 9,200 truck trips (out and return).

- For the section Serres – Nea Messimvria (84,7 km length) almost 4,800 pipes will need to be delivered to the construction site. This corresponds to approximately 2,400 lorry loads (one-way) from the port of Thessaloniki, i.e. almost 4,800 truck trips (out and return), to the main pipe yard, etc.

- For the section Nea Messimvria to the Greek/Albanian (184 km length) border roughly 12,000 line pipes will need to be delivered to the working strip from the harbour of Thessaloniki via the designated pipeways along the route and the access roads from the pipeways to the working strip. This will total almost 8,000 long-trailer truck loads (one-way) from the harbour to the pipeways.

- The transport of padding material in which the pipeline will be bedded results in substantial transportation requirements: approximately 117,000 truckloads, via the access routes, to the pipeline trenches all along the pipe line route (assuming use of a standard 28 tonne tipper truck for delivery).

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66 Standard lengths: 18 m
67 ca. 3,226 loads of 18 m pipe (2 pipes per truck).
68 Standard lengths: 12 m and 18 m
69 ca. 6,000 loads of 12 m pipe (3 pipes per truck) plus ca. 2,000 loads of 18 m pipe (2 pipes per truck) – indicative calculations based on preliminary logistic concept and subject to detailed design.
In addition to the above transportation requirements, daily transport of personnel from the camps to the worksite has also been considered.

The largest transport units will be Turbo Compressors with a maximum total weight of 40 to 100 tons. Proposed locations for compressor stations are close to main national roads, providing easy access from the ports of Thessaloniki, Kavala and Alexandroupolis.

Construction logistic are outlined in the Logistics Concept for Greece (GPL00-ILF-100-F-TRP-0003 Rev 0C, dated 2011-08-22, prepared by ILF for the West Section) and Logistic Report (GPL00-ENT-100-F-TRP-0003 Rev.: 0A prepared by ENT for the East Section). These reports identify the physical capacity of the existing road network to carry construction vehicles and the type and current condition of the road surfaces.

The logistics study has also identified the need to upgrade a total of 27 km of small roads and tracks and access routes for pipe delivery in the more remote areas of the route between Nea Messimvria and the Greek/Albanian border. Potential development of existing roads the Turkish – Greek border and Nea Messimvria is under investigation and will be established early in the construction phase.

Some abnormal loads will need to be delivered from time to time during the construction phase. These will be scheduled wherever possible during off-peak periods on the road network.

During the early stages of the works, there will be a small number of workers based in the field construction sites while during the later stages of construction there will be a larger number of workers based in construction sites (up to 200 people each).

The construction traffic prognosis (Site Traffic Estimation Greece West Study GPL00-ENT-100-F-TCE-0001 Rev 0B, dated 2012-03-02, prepared by ENT and Site Traffic Estimation Greece East GPL00-ENT-100-F-TCE-0002, Rev 0A, dated 2013-01-14) provides a preliminary estimation of the potential numbers of construction logistics movements at possible construction traffic hot-spots on the main transport and access routes along the pipeline route (these calculations are available for 31 traffic nodes along the pipeline route, from which 21 were in the West Section and 10 in the East Section). These preliminary figures include the above main construction traffic items.
Further, baseline traffic counts were undertaken during April 2012 for a subset of 5 traffic nodes which were identified as likely hot-spots to further inform the assessment70.

The following tables (Table 8-95 and Table 8-96) summarize the Traffic Prognosis for 16 selected traffic nodes of the East section and more detailed information can be found in Annex 6.3. Based on the Site Traffic Estimation Greece East the following transportations have been taken into consideration.

- pipe transport from harbour to pipe yard
- pipe transport from pipe yards to working strip
- soil transport from working strip to laydown area (approx. 5 km distance)

Table 8-95 Construction Traffic Prognosis for selected Traffic Nodes along the Route (From Kipoi to Komotini)

<table>
<thead>
<tr>
<th>Section</th>
<th>Node #</th>
<th>Description</th>
<th>Construction Traffic Movements (in 2016) [preliminary and indicative]</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Evros</td>
<td>1</td>
<td>Section E75 -Tavri</td>
<td>159</td>
</tr>
<tr>
<td>Southern Evros</td>
<td>2</td>
<td>Section Alexandroupoli-Feres-Ardanio</td>
<td>1.431</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Section Alexandroupoli-Apalos-Amfitriti</td>
<td>16.724</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Alexandroupolis port</td>
<td>32.346</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>MPY02 B Pipeyard Alexandroupolis</td>
<td>371</td>
</tr>
<tr>
<td>Lowlands of Evros</td>
<td>6</td>
<td>Mesti junction</td>
<td>537</td>
</tr>
</tbody>
</table>

Compiled by EXERGIA (2013) from Site Traffic Estimation Greece East Study (Doc. Ref. GPL00-ENT-100-F-TCE-0002 Rev 0A, dated 2013-01-14, prepared by ENT)

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70These 5 locations were selected from the 20 construction traffic prognosis nodes by combining high predicted construction traffic numbers and local traffic network context. It must be noted that this limited number at present planning stage provides only for an indication of potentially critically construction traffic situations. It cannot provide a representative and detailed assessment at this stage of planning. The further ongoing detailing of the logistics concept will need to look into this in more detail.
Table 8-96  Construction Traffic Prognosis for selected Traffic Nodes along the Route (From Komotini to Thessaloniki)

<table>
<thead>
<tr>
<th>Node #</th>
<th>Description</th>
<th>Location</th>
<th>Construction Traffic Movements (in 2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intersection Between exit ramp of E90 with Komotini – Alexandroupoli National Road</td>
<td>Komotinis – Alexandroupolis (O.N.R)</td>
<td>537</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exit ramp of E90</td>
<td>537</td>
</tr>
<tr>
<td>2</td>
<td>Regional Road of Komotini-Palaia Maronia</td>
<td>Regional Road of Komotini-Palaia Maronia</td>
<td>45.379</td>
</tr>
<tr>
<td>3</td>
<td>Exit E90 to Komotinis-Kikidio at junction Komotinis-</td>
<td>Xanthis - Komotinis (O.N.R)</td>
<td>1.485</td>
</tr>
<tr>
<td></td>
<td>Alexandroupoli National Road and Xanthi – Komotini National Road</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Road connecting the port of Kavala with the adjacent junction of E90</td>
<td>Road connecting the port of Kavala with the adjacent junction of E90</td>
<td>2.817</td>
</tr>
<tr>
<td>6</td>
<td>Intersection between Exit ramp from E90 with Dramas-Kavalas National Road</td>
<td>Dramas – Kavalas National Road</td>
<td>15.038</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exit ramp from E90</td>
<td>7.519</td>
</tr>
<tr>
<td>7</td>
<td>Regional Road Pentapoli - Pethelinon</td>
<td>Serres - Drama</td>
<td>Data will be provided at a later stage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Road To Toumpa</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Intersection between Thessaloniki – Serres National Road with Lagada -</td>
<td>Thessaloniki – Serres National Road</td>
<td>Data will be provided at a later stage</td>
</tr>
<tr>
<td></td>
<td>Nees Serres Regional Road</td>
<td>Lagada - Nees Serres Regional Road</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Intersection between Thessaloniki – Serres National Road with Lachanas -</td>
<td>Lachanas – Theodosia</td>
<td>Data will be provided at a later stage</td>
</tr>
<tr>
<td></td>
<td>Evaggelistria Road</td>
<td>South of Egnatia Motorway</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lachanas - Isioma</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Intersection between Thessaloniki - Serres (O.N.R)</td>
<td>Thessaloniki - Serres (O.N.R)</td>
<td>63.512</td>
</tr>
<tr>
<td></td>
<td>Assiros exit road</td>
<td>Assiros - Krithia</td>
<td>63.512</td>
</tr>
</tbody>
</table>

Compiled by ASP (2013) from Site Traffic Estimation Greece East GPL00-ENT-100-F-TCE-0002, Rev 0A, dated 2013-01-14 prepared by ENT

The following Table 8-97 summarizes the Traffic Prognosis for 21 selected traffic nodes of the west section.
Table 8-97 Construction Traffic Prognosis for selected Traffic Nodes along the Route (West Section)

<table>
<thead>
<tr>
<th>Section</th>
<th>Node #</th>
<th>Description</th>
<th>Construction Traffic Movements (in 2016) [preliminary and indicative]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axios plain</td>
<td>1</td>
<td>Section Aghialos-N.Messimvria</td>
<td>188,659</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>E75 going to Skopje</td>
<td>4,313</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Section E75 -Valtochori</td>
<td>81,809</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Section Chalkidona-Alexandria</td>
<td>53,926</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Junction south of Pella</td>
<td>63,703</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Crossroads in Galatades</td>
<td>2,557</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Section Giannitsa-Alexandria</td>
<td>3,164</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Bridge over tributary to Aliakmonas(SE of Skydra)</td>
<td>55,553</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Section Skydra-Veroia</td>
<td>80,210</td>
</tr>
<tr>
<td>Vermio Mtn.</td>
<td>10</td>
<td>Crossing local roads with road Edessa Naousa near</td>
<td>9,891</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BVS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Crossroad Kato Grammatiko</td>
<td>10,422</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Section to Purgi (junction at camp site)</td>
<td>30,913</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Section to Filotas</td>
<td>38,698</td>
</tr>
<tr>
<td>Ptolemaida Basin</td>
<td>14</td>
<td>Section Perdikas -Ptolemaida</td>
<td>7,254</td>
</tr>
<tr>
<td>Askion Mnt.</td>
<td>16</td>
<td>Eastern approach Kleisoura pass</td>
<td>2,343</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>Section Ptolemaida-Kleisoura (Kleisoura pass)</td>
<td>14,936</td>
</tr>
<tr>
<td>Region W. of</td>
<td>18</td>
<td>Pipe yard #4 Korissos Junction south of pipeyard</td>
<td>76,640</td>
</tr>
<tr>
<td>Kastoria</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>Junction to Militsa (south of camp)</td>
<td>273</td>
</tr>
<tr>
<td></td>
<td>20a</td>
<td>Junction between Argos Orestiko Dispilio</td>
<td>12,593</td>
</tr>
<tr>
<td></td>
<td>20b</td>
<td>Highway Junction between Argos Orestiko and</td>
<td>60,740</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ampelokipoi</td>
<td></td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>Pipeyard #5 Mesopotamia (junction east of the</td>
<td>31,403</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pipeyard)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>NE of Mesopotamia (Agia Kyriaki crossroads)</td>
<td>18,715</td>
</tr>
</tbody>
</table>

Compiled by ERM (2012) from Site Traffic Estimation Greece West Study (Doc. Ref. GPL00-ENT-100-F-TCE-0001 Rev 0B, dated 2012-03-02, prepared by ENT)

The following types of impacts will likely be arising from the above described construction traffic:

- **Road User Delays**: Simultaneous construction at more than one site including spoil pipework delivery could result in a large amount of traffic in the surrounding area, which will affect daily road users including local public transport, school bus services etc.;

- **Impacts on Safety of Road Users and Others**: Due to the increase in construction traffic, there is a potential for increases in road accidents. The type of construction traffic i.e. slow moving trucks may also increase the level of overtaking especially where heavy vehicles need to use local roads outside of the main road network;
• **Roadway Infrastructure Degradation**: The use of the road network by heavy vehicles can lead to wear and damage of the roadway surface, kerbs and pavements. Traffic volume and certain vehicle parameters, e.g. axle-load and spacing as well as existing infrastructure quality are the key determinants of infrastructure degradation; and

• **Increased Levels of Noise, Vibration and Air Pollution from traffic movements**: Traffic volume, vehicle types, operating speeds as well as proximity to receptors are key determinants of these traffic emissions related impacts.

There is no established guidance or evaluation threshold for assessing the significance of short-term traffic impacts associated specifically with temporary construction activities (generally guidance and criteria are focussed on long term traffic generation e.g. from new main roads)\(^{71}\).

The evaluation of significance is based on the characteristics of the study area, the sensitivity of the location and the characteristics of any potential impacts, taking into account factors such as the existing and additional project traffic flows, road infrastructure quality, vehicle types and the proximity of communities to the road.

Thus, the assessment of construction traffic impacts for the Project has focussed on the level of additional heavy vehicle traffic generated by Project construction taking the following factors into account:

• The nature and type of the road being used by construction traffic;
• The presence of communities or settlements along construction traffic routes; and
• The existence of known congestion or safety problems on the network.

As a result of the construction traffic prognosis provided in *Table 8-95, Table 8-96 and Table 8-97 for the East and West Section*, the following likely hot-spots for construction traffic have been identified and presented in *Table 8-98 (East Section)* and *Table 8-99 (West Section)*. This is based on the highest predicted additional traffic loads and taking into consideration how the traffic node is connected\(^{72}\).

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\(^{71}\)This is in part because construction traffic is generally considered to be a temporary impact that has a limited duration. There are various ways of interpreting whether or not an impact will have a significant effect and the following guidance is given in the IEMA Guidelines for the Environmental Assessment of Road Traffic (Guidelines for the Assessment of Road Traffic produced by the Institute of Environmental Assessment (IEA, 1993) now the Institute of Environmental Management and Assessment (IEMA, http://www.iema.net/home) which in summary says that where no established thresholds exist, the assessment should look at the local circumstances to decide on the significance of the impacts.

\(^{72}\)At prognosis point 20b, 60,000 construction vehicles are anticipated in 2016 (or peak average 26 vehicles/hour); however this is a high capacity junction by layout and thus not considered critical.
### Table 8-98  Anticipated Construction Traffic Hot-spots between Kipoi and Nea Messimvria

<table>
<thead>
<tr>
<th>Traffic Node</th>
<th>Description</th>
<th>Location</th>
<th>February 2013 baseline traffic counts*</th>
<th>Predicted construction traffic movements (all in 2016)**</th>
<th>Approx. % increase Project traffic will have on current vehicle/hour baseline flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Regional Road of Komotini-Palaia Maronia</td>
<td>Regional Road of Komotini-Palaia Maronia</td>
<td>4,096 movements or average 256 vehicles/ hour</td>
<td>45,379 movements/year or average 15 vehicles/ hour</td>
<td>6%</td>
</tr>
<tr>
<td>5</td>
<td>Road connecting the port of Kavala with the adjacent junction of E90</td>
<td>Road connecting the port of Kavala with the adjacent junction of E90</td>
<td>128 movements or average 8 vehicles/ hour</td>
<td>2,817 movements/year or average 2 vehicles/ hour</td>
<td>25%</td>
</tr>
<tr>
<td>10</td>
<td>Intersection between Thessaloniki - Serres National Road / Assiros exit road</td>
<td>Thessaloniki - Serres (O.N.R)</td>
<td>2,638 movements or average 165 vehicles/ hour</td>
<td>63,512 movements/year or average 21 vehicles/ hour</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>Assiros - Krithia</td>
<td></td>
<td>1,498 movements or average 94 vehicles/ hour</td>
<td>63,512 movements/year or average 21 vehicles/ hour</td>
<td>22%</td>
</tr>
</tbody>
</table>

* (total = bothways. Counts undertaken on a weekday over a 16 hour period between 0600 and 2200)
** (assumptions: predicted traffic movements / 255 workdays/ distributed over 12 hours daily (0700 – 1900 driving time) = average construction traffic movements / hour)

Source: Asprofos (2013)

### Table 8-99  Anticipated Construction Traffic Hot-spots between Nea Messimvria and the Albanian border

<table>
<thead>
<tr>
<th>Traffic node #</th>
<th>Description of construction traffic hot spot situation</th>
<th>April 2012 baseline traffic counts*</th>
<th>Predicted construction traffic movements (all in 2016)**</th>
<th>Approx. % increase Project traffic will have on current vehicle/hour baseline flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Section E75 – Valtochori – intersection (not-signal regulated T-off) with local road that leads towards south and serves as village connector will be used as haul route</td>
<td>18,036 movements or average 1,127 vehicles/ hour</td>
<td>181,000 movements/ year or average 59 vehicles/hour</td>
<td>5%</td>
</tr>
<tr>
<td>9</td>
<td>Section Skydra-Veroia – regional cross roads and connected with Pipeyard #2</td>
<td>4,132 movements or average 258 vehicles/ hour</td>
<td>80,000 movements/ year or average 26 vehicles/hour</td>
<td>10%</td>
</tr>
<tr>
<td>18</td>
<td>Pipeyard #4 Korissos Junction south of pipeyard – this is close to pipeyard #4 and on a main East – West regional settlements connector</td>
<td>1,990 movements or average 124 vehicles/hour</td>
<td>76,000 movements/ year or average 26 vehicles/hour</td>
<td>20%</td>
</tr>
</tbody>
</table>
Traffic node #9 (West Section): the Director of Pella Traffic Police recalled approximately 40 accidents (with two injuries and two fatalities) in the last 1.5 years, potentially due to the poor surface condition of the road which has deteriorated from frequent use by agricultural machinery and the straight sections of the road encouraging high speeds.

Traffic node #21 (West Section): the Director of Kastoria Traffic Police reported the national road Kastoria – Nestorio is considered an important axis as it connects two large cities and several smaller villages and carries a significant volume of traffic. 20 accidents were reported in the past 12 months with two injuries and one fatality. It was also reported that, despite the proximity to Larco Nickel mine operations near Iepigiri village to the west of Mesopotamia, the road is not used by the trucks of the mining operations, as these have alternative ways to reach Egnatia highway.

Traffic node #6 (East Section, Komotini - Thessaloniki): Minor safety issues were reported for the Node #6 (20 severe accidents in five years resulting 5 injuries and no fatalities).

Traffic node #1 (East Section, Komotini - Thessaloniki): The authorized official, from the local traffic police department, who was interviewed by phone, reported 2 accidents with 2 slight injuries during the last 5 years. He also reported 5 accidents with 6 slight injuries at the adjacent junction to Kikidio.

Traffic node #2 (East Section, Komotini - Thessaloniki): The authorized official, from the local traffic police department, who was interviewed by phone, reported 3 accidents with 3 slight injuries during the last 5 years.
The anticipated hot-spots identified in Table 8-98 and Table 8-99 do not preclude other parts of the traffic network as additional hot-spots could arise. However, based on the presently available level of detail from the Construction Concept, the high intensity construction traffic with large vehicles at a rate of average 1 or 2 per minute flag up the locations and road section where traffic management will require special attention.

8.16.2.2 Mitigation Measures

A Traffic Management Plan will be developed by TAP AG and any commissioned EPC contractor in consultation with the regional and local competent authorities, traffic police and municipalities, and implemented throughout construction.

Detailed mitigation measures will be adopted in the project Traffic Management Plan and will include:

- Strict speed limits;
- precautions will be taken by the Contractor to avoid damage to the public;
- advance warning will be given of any proposed road diversions and closures;
- drivers of Project vehicles will be trained/briefed about safe driving with respect to other drivers, non-motorised traffic such as pedestrians, cyclists, and livestock;
  clear signs, flagmen and signals will be set up where necessary;
- all Project vehicles will be regularly maintained;
- assignment of heavy vehicle construction traffic to suitable routes to and from the working area;
- education on traffic safety will be provided by the Community Liaison Officers (CLOs) to communities (incl. schools, kindergartens) not normally subjected to high traffic loads;
- provision shall be given for the continuation of normal traffic during open-cut road crossings; and
- access and site roads will be maintained in good condition.
8.16.2.3 Residual Impacts

The presence of Project-related traffic on local roads along the pipeline route is inevitable and may lead to delays for local traffic during the construction period. The key risk is that this may lead to inappropriate over-taking of slow moving construction vehicles and introduce a safety hazard to non-motorised road users on these roads, where they are used to low levels of baseline traffic. However, impacts on the local road network from Project-related traffic movements will be temporary and short-term (associated with the duration of construction i.e. within 2016) and will be managed through the application of a Traffic Management Plan. On the basis that appropriate mitigation measures are implemented through this plan and that monitoring shows these to be effective, the overall residual impact will be expected to be of minor significance.

The following Table 8-100 presents a summary of the residual impacts.

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| Disruption to existing road users on local roads. | Development and adherence to a Traffic Management Plan that will include:  
  - Drivers of Project vehicles will be trained/briefed about safe driving  
  - Strick speed limits  
  - Regular maintenance of vehicles  
  - Assignment of heavy vehicle construction traffic to suitable routes  
  - Awareness raising for workers with respect to safe and considerate driving  
  - Advance warning will be given of any proposed road diversions and closures  
  - Contractor to avoid damage to the public  
  - Clear signs, flagmen and signals will be set up where necessary.  
  - Education on traffic safety will be provided by the Community Liaison Officers (CLOs) to communities not normally subjected to high traffic loads.  
  - Provision shall be given for the continuation of normal traffic during open-cut road crossings.  
  - Access and site roads will be maintained in good condition. | At Hot Spot Locations **MINOR** residual risk remains as follows:  
  - A Minor residual risk of delays is still possible behind slow moving construction vehicles. The implementation of the embedded mitigation measures and the application of the TMP will however keep this risk as low as reasonably practicable.  
  - Minor residual road safety risks are still possible. The implementation of the embedded mitigation measures and the application of the TMP will however keep this risk as low as reasonably practicable.  
  - **Minor residual road degradation risks** are still possible. The implementation of the embedded mitigation measures and the application of the TMP will however ensure that construction vehicles travel on roads of a suitable standard and that any road degradation is repaired. The application of these measures will keep this risk as low as reasonably practicable. |
| Road safety.                          |                                                                                                       |                                        |
| Highway degradation.                  |                                                                                                       |                                        |

*Source: ERM (2012) and ASPROFOS (2013)*
8.16.3 Operation and Maintenance Phase

8.16.3.1 Potential Impacts

Traffic generated by the operational phase will be very low and associated mainly with routine inspection and maintenance of the pipeline and block valve stations. Road capacity and road safety thus does not pose an issue during operation.

8.16.3.2 Mitigation Measures

No significant traffic impacts will occur during operation. No specific mitigation measures are therefore required.

8.16.3.3 Residual Impacts

There will be no significant residual traffic impacts during operation.

8.16.4 Decommissioning Phase

8.16.4.1 Potential Impacts

Pipeline decommissioning, depending on the approach and technologies available at the time of decommissioning, could create similar construction traffic issues like construction, in particular if the pipeline is removed from the ground.

8.16.4.2 Mitigation Measures

A Decommissioning Traffic Management Plan will be developed in consultation with the competent authorities, traffic police and municipalities, and implemented throughout decommissioning.
8.16.4.3 Residual Impacts

Residual traffic impacts will be similar to those of construction, depending on if the pipeline is fully or partially removed, or left in the ground.

8.16.5 Summary of Impacts on Traffic and Transport

*Construction and Pre-Commissioning Phase:*
The preliminary Logistics Concept for the pipeline section from Kipoi to the Greek/ Albanian border indicates that road traffic generated by the construction activities will be substantial and this will add to existing traffic.

Road conditions and capacity of the road network in the regions where the pipeline passes is generally good. The main road axis in the region of Central, East Macedonia, and Thrace is Egnatia Motorway (European Road E90) and its northbound connecting roads. Consultations with regional road administration and traffic police undertaken in the course of the ESIA preparation have not identified particular critical hot-spots.

However reasons were reported to explain the relatively large number of accidents on rural roads. This inter alia includes seasonally more dangerous traffic conditions due to the transportation of large volumes of local agricultural produce, such as fruits, in the summer and long straight road segments which allow the drivers to increase speed and undertake risky overtaking manoeuvres.

Traffic baseline counts undertaken and construction traffic prognosis for construction logistics for key routes and traffic nodes suggest that daily road users offside from the main road network will be likely confronted with delays over the construction period mainly caused by the slow moving heavy load traffic, such as the line pipe trailer trucks on logistics routes. This additionally will likely increase overtaking actions by road users and thus traffic accident risk. Construction traffic, particularly on remote local roads, may also present a hazard to pedestrians and cyclists and livestock that will be less used to frequent and heavy vehicle movements. This will also be the case where logistic routes cannot avoid passage through settlements in more remote regions.
In order to minimise hindrance, delays and traffic risks, TAP AG will develop a *Traffic Management Plan* based on the detailed logistics. This plan will be consulted with regional and local administration and agencies including traffic police.

**Operation and Maintenance Phase:**

During Operation of the pipeline system, there will be only a few maintenance and patrol vehicles in regular operation. Therefore no relevant traffic impacts will occur.

### 8.17 Cultural Heritage

**8.17.1 Overview**

This Section assesses the impacts caused by the Project in Greece on cultural heritage resources, namely impacts on:

- Archaeological sites;
- Monuments; and
- Sites with intangible cultural heritage (ICH) value.

As a part of the Project’s options appraisal, route refinement, and final assessment, the Project has sought to avoid, minimise and mitigate impacts on the cultural heritage environment. This Section presents an assessment of potential impacts, specific mitigation measures, and anticipated residual impacts associated with the cultural heritage environment. The *Box 8-19* below outlines the key sources of impact, the potentially impacted resources and receptors, including baseline and Project influencing factors associated with impacts of the Project on cultural heritage sites.
Box 8-19  Key Considerations for Assessment – Cultural Heritage

Sources of Impact/ Risk

- Construction Phase: ground-disturbing activities, including land-clearing and site preparation activities associated with Project facilities, excavation of the pipe trench, renovation of roads; construction of temporary facilities such as camps and pipe yards; pollution (mainly dust) and vibration from blasting, hammering, and the movement of vehicles, equipment and personnel.
- Operation Phase: Pollution (mainly dust) and vibration from the movement of vehicles, equipment and personnel.
- Decommissioning Phase: Pollution (mainly dust) and vibration from the movement of vehicles, equipment and personnel.

Potentially Impacted Resources and Receptors

- Archaeological sites, Monuments, and Sites with ICH value.

Particular Baseline Conditions that are Potentially Influencing Impacts/ Risks

- Presence of 87 known sites within the cultural heritage ESIA study area; high potential for impacts on unknown subsurface archaeological resources, particularly in the 68 areas of high archaeological potential (all associated with confirmed cultural heritage sites) identified within 50 m of the Project footprint.

Project Factors that are Potentially Influencing Impacts/ Risks

- Prior re-routing studies and Project design to avoid cultural heritage sites, ESIA investigations producing maps and information on cultural heritage sites in the study area, Cultural Heritage Management Plan, Chance Finds Procedures, requirements in the workers’ Code of Conduct, alternative low impact and vibration minimizing construction techniques, including a reduced working strip, management of the movement of vehicles, equipment and personnel.

References

- Baseline is found in Section 6.5. Impact Assessment Criteria is found in Annex 5.9. Monitoring Measures are described in Section 9.2.


Table 8-101 presents the key impacts of the Project cultural heritage sites identified for the different project phases.

Table 8-101  Key Impacts – Cultural Heritage

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Direct physical disturbance of or damage to the sites;</td>
<td>- No anticipated impacts on known heritage.</td>
<td>- Degradation of or damage to above-ground structures due to pollution or vibration.</td>
</tr>
<tr>
<td>- Degradation of or damage to above-ground structures due to pollution or vibration;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Disruption to visitors of cultural heritage sites;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Negative effects on the setting or ambience of cultural heritage sites.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012)
The following Sections expand on the potential impacts and discuss necessary measures to address identified impacts/risks.

8.17.2 Potential Impacts

The four categories of potential impacts identified in this assessment are:

- Direct physical disturbance of or damage;
- Degradation or damage due to pollution and vibration;
- Disruption to visitor access; and
- Negative effects on setting and ambience.

Known characteristics of cultural heritage sites and Project activities were used to determine which impacts will be relevant to which sites. Due to the nature of construction activities, all cultural heritage sites, whether above or below ground, are at risk of direct physical impacts. Pollution (mainly dust) and vibration will only affect above ground standing features or buildings. Impacts on user access, setting, and ambience are only applicable to sites that receive visitors or have users. Using this approach, the magnitude and nature of impacts on different categories of cultural heritage sites have been assessed, and are presented in the following Sections.

8.17.2.1 Direct Physical Disturbance of or Damage to Cultural Heritage Sites

Direct physical disturbance of or damage to cultural heritage sites will result in the loss of scientific, historic, or cultural value. Ground-disturbing activities, including vegetation and topsoil removal, grading, and excavations, are the key sources of impact, as these activities have the potential to damage archaeological resources. The movement of heavy equipment and vehicles in the working strip may also compress or otherwise distort subsurface archaeological resources, which can in turn cause loss of the scientific and historic value inherent in the remains.

Site preparation and other construction activities will result in the disturbance of topsoil and subsoil within a 38 m wide working strip around the base case route centreline. Therefore, if archaeological sites in proximity to the pipeline cannot be avoided through on-site micro-rerouting, a 28 m wide reduced working strip or a 18 m minimum working strip may be adopted.
(CPL00-ENT-100-F-TAS-0001_02, 2012) instead. Additionally, disturbance of or damage to cultural heritage sites may occur when roads are upgraded and in areas required for the structures associated with the compressor stations, block valve stations, pipe yards, construction camps and other Project logistics.

The area of direct physical impacts is defined as the Project footprint. For the pipeline, the minimum width that will be affected by construction phase activities is the 18 m wide minimum working strip. The minimum working strip is asymmetrical and can extend 9.3 m from the centreline on its widest side (CPL00-ENT-100-F-DFT-0011_02, Rev. 2, Working Strip, 02-02-2012). Based on these dimensions, the assessment assumes that any cultural heritage sites 10 m or less from the centreline will be physically impacted by construction.

Direct physical impacts are only anticipated during the construction phase of the Project. Areas where direct physical impacts are anticipated include:

- a possible cultural cairn in Pefka (CH-383-E) within minimum working strip, near KP 26
- part of an aqueduct system in Amfitriti (CH-335-E), intersecting the minimum working strip and possibly the centreline, near KP 41
- a stone paved road in Palagia (CH-394-E) intersecting pipeline trench and possibly the centreline, near KP 46
- an fire tower in Sykorachi (CH-334-E), intersecting the minimum working strip and possibly the centreline, near KP 57
- an extensive pottery scatter in Sykorachi (CH-388-E) within the minimum working strip, near KP 63
- a low density pottery scatter in Thrylorio (CH-391-E) intersecting the centreline, near KP 87,
- In Galini Area (CH-34-E), near KP 110, parts of modern roof tiles in low density were identified during the field survey along the route. This area of high archaeological potential intersects the centreline.
- In Koptero Area (CH-33-E), near KP 119, three ceramic scatters and roof tiles in medium density, probably Historic, were identified during the field survey along the route. This area of high archaeological potential intersects the centreline.
- The Justinian Walls and Aqueduct (CH-36-E), near KP 123, is an officially recognized archaeological site, intersecting the centreline.
- Along the banks of Kossinthis River (Xanthhis River) (CH-25-E), near KP 136, although no visible artefacts were recorded during the field survey, the area is of high archaeological potential, since graves of the Iron Age and of the Roman Period as well as a settlement of the Early Bronze Age, have been excavated in the broader area in the past (CH25a-E). The site intersects the centreline.

- The site of Paradeisos - Kilisi Tepe (CH-12a-E), near KP 154, an officially recognized prehistoric settlement, intersects the regular working strip.

- In the area of Pondolivado (CH-10a-E), near KP 172, the officially recognized archaeological site of Ancient Pistoros (settlement and findings of the Classical and Hellenistic period) intersects the minimum working strip.

- The ancient town of Nea Komi, an officially recognized archaeological site (CH-13a-E), near KP 176, intersects the minimum working strip.

- The Wall of Kavala (CH-4LK-E), near KP 178, intersects the centreline. It is an officially recognized monument of the Byzantine, Post-Byzantine period.

- The recorded area of Athanato nero, Rachovouna, at the area of Mesorachi (CH-19LS-E), near KP 240, intersects the minimum working strip. Cemeteries of the Classical Period and the Hellenistic Times have been recorded by the competent authority.

- The Hill of Toumpa, in Nea Zichni (CH-23LS-E), near KP 244, intersecting the centreline. It is an officially recognized prehistoric settlement.

- The area of high archaeological potential of Peristerias (CH-3-E), near KP 259, intersects the centreline. The area is located on a ridge/ mound of irregular shape with ceramic scatters in low density but is probably connected to the officially recognized archaeological site of Alonia/ Peristerias (CH-8L27TH-E)

- The possible ancient settlement of Korissos. The finding of Korissos is represented by a number of ceramic scatters intersecting the centreline (CH-29, CH-30, CH-31, CH-32 & CH-33) and by the results of a visual analysis of aerial photography and infrared images. Crop markings were visible on the landscape around these scatters, suggesting the remains of ancient subsurface structures from KP 497 to KP 506. Further analysis of recent historical photographs was conducted to compare Modern period land use patterns with markings identified in satellite images. Results of the analyses indicate that some of the visible markings represent fairly recent agricultural patterns, while may indeed represent subsurface ancient features. More investigation into modern land use practices and intrusive archaeological testing will be required to confirm the contents of the Korissos finding.
Sites identified outside the regular working strip but within 50 m from the Project footprint will possibly also sustain direct physical impacts. These include:

- a possible cultural mound in Sykorachi (CH-389-E) located at the edge of the regular working strip, near KP 63
- a low density pottery scatter in Pamforo (CH-354-E), near KP 84
- a cultural mound (CH-346-E) and a low density pottery scatter (CH-347-E) in Pylaia, near KP 22
- a cist grave in Itea (CH-350-E), near KP 11
- the chapel of Aghios Markos in Palagia (CH-339-E), near KP 46,
- pottery scatters in Amfitriti (CH-376-E), located 5 m from GBVS02, near KP 42,
- in Pamforo (CH-353-E), near KP 84
- Along the banks of Kossinthos River (Xanthis River) (CH-25a-E), near KP 136, officially recorded installations and a cemetery of Early Bronze Age, Early Iron Age and Imperial Times, officially recorded.
- In Nea Amisos (CH-20-E), near KP 147, although no visible artefacts were recorded during the field survey, ceramic scatters of the Archaic and the Classical Period of Avdera, as well as architectural parts have been found in past surveys. The connection of the CH-20-E area with the officially recognized Archaeological area of the mound of Galazia Korifi should be further investigated and discussed with the competent Ephorate which has classified the area as having high archaeological potential.
- In the ‘Hill of Ephoron’, in Poimni (CH-18-E), near KP 150, where according to the competent authority, a settlement of the Imperial Years and a settlement of the Post-Byzantine period are known to exist. The indications of the field survey did not provide substantial evidence to this direction but the area is still considered to be of high archaeological potential.
- The officially recognized archaeological site of Pentalofos Oreokastro (CH-31LT-E), near KP 360, includes settlements and tombs of the Bronze and Iron Age, Archaic, Classical and Historic Periods.

Two sites, an ancient tomb (CH-250-E), near KP 21, and an area with settlement remains in Kavissos (CH-352-E), near KP 14, although within 50m from access road are not expected to sustain any direct impacts since they are located close to a pre-existing road (Egnatia highway) that does not need to be upgraded.
Known cultural heritage sites may be avoided by pre-construction design modifications, substantially reducing the likelihood of impacts. Unknown archaeological sites, on the other hand, are likely to exist, but their presence may only be revealed by ground-disturbing activities.

8.17.2.2 Degradation or Damage to Cultural Heritage Sites Due to Pollution or Vibration

Above-ground portions of cultural heritage sites are subject to impacts from air pollution (mainly dust) and vibration caused by the operation of machinery, heavy vehicle traffic, and high-impact activities such as blasting and machine-powered hammering. Depending on their structural condition, sites with standing or partially standing features, such as commemorative monuments, historic buildings, or architectural remains, may be at risk of degradation or collapse due to vibration. Air pollutants can also collect on the outer surface of structures in the form of dust and soot, causing discoloration and corrosion of building material. Stone structures are particularly sensitive to the corrosive effects of air pollution.

Blasting, hammering, the operation of heavy machinery and the movement of vehicles along unpaved areas, are likely to produce vibration and dust which will impact cultural heritage resources. These types of impacts will be most significant during the construction phase.

Sites with above ground portions located within the project footprint in which blasting and hammering is predicted to occur include:

- part of an aqueduct system in Amfitriti (CH-335-E) intersecting the minimum working strip and possibly the centreline, near KP 41
- a road shrine in Amfitriti (CH-336-E), near KP 41
- an unknown church in Palagia (CH-370-E), near KP 45,
- a stone paved road (CH-394-E) in Palagia intersecting the pipeline trench and possibly the centreline, near KP 46
- the chapel of Aghios Markos in Palagia (CH-339-E), near KP 46,
- The site of Paradeisos - Kilisi Tepe (CH-12a-E), near KP 154, an officially recognized prehistoric settlement, intersecting the regular working strip.
The Justinian Walls and Aqueduct (CH-36-E), near KP 123, is an officially recognized archaeological site, intersecting the centreline.

The Toumpa of Perni (CH-11a-E), near KP 168, outside the regular working strip (approximately 55 m from the centreline). It is a settlement of the Prehistoric and Historic Times as well as a cemetery of the Post-Roman and Byzantine Period, discovered during the construction activities of the natural gas pipeline in 2000.

In the area of Pondolivado (CH-10a-E), near KP 172, the officially recognized archaeological site of Ancient Plistiros (settlement and findings of the Classical and Hellenistic period) intersects the minimum working strip.

The ancient town of Nea Komi, an officially recognized archaeological site (CH-13a-E), near KP 176 intersects the minimum working strip.

The Akontisma of Nea Karvali, is an officially recognized archaeological site (CH-14-E), near KP 178, at a distance of approximately 300 m. It is characterized by architectural remnants of an ancient fortified town, located on a hill.

The Wall of Kavala (CH-4LK-E), near KP 178, intersects the centreline. It is an officially recognized monument of the Byzantine, Post-Byzantine period.

The recorded area of Athanato nero, Rachovouna, at the area of Mesorachi (CH-19LS-E), near KP 240, intersects the minimum working strip. Cemeteries of the Classical Period and the Hellenistic Times have been recorded by the competent authority.

The Hill of Toumpa, in Nea Zichni (CH-23LS-E), near KP 244, intersects the centreline. It is an officially recognized prehistoric settlement.

Impacts due to vibration and dust may also occur near roads that will receive heavy vehicle traffic, which are expected to have a higher volume during construction. The assessment evaluates impacts on sites located within approximately 50 m of the edge of logistic roads within the 2 km corridor. Logistic roads that extend beyond the 2 km corridor are expected to receive much lower levels of traffic throughout the Project.

The state of preservation and structural integrity of cultural heritage sites within the study area will be assessed prior to construction. If necessary, sites will be braced, reinforced or covered to protect their condition. The majority of sites at risk from dust and vibration impacts are located along logistic roads. Cultural heritage sites within 50 m of logistic roads within the 2 km-wide corridor include: an ancient tomb (CH-250-E) in Pylaia, near KP 21, chapels (CH-125, CH-162 & CH-213), churches (CH-88, CH-121, CH-79, CH-215, CH-212, CH-137, & CH-214), the
Monastery of Virgin Mary in Kleissoura (CH-130) and Kastro bridge (CH-83). Another stone bridge (CH-37), from the Hellenistic or Roman period, is sensitive to vibration and dust impacts from traffic along the working strip. The Church of the Assumption (CH-115) is also more sensitive to impacts, as it is located both on a logistic road and within 50 m of the pipeline. An assessment of the structural stability and condition of these sites will be undertaken before the start of construction. Structural reinforcement, bracing and other protective measures will be implemented where necessary. For Omali Mikros (CH-347), an archaeological site reported by the 30th Ephorate, further investigation is necessary to characterize the site and confirm whether dust and vibration are potential impacts.

During the operation phase, vehicle traffic is not anticipated to reach thresholds that will cause negative effects. Impacts during the decommissioning phase are expected for sites within 50 m from logistic roads and from Compressor Station and BVS that will require decommissioning. They are anticipated to be similar to those in the construction phase but are of less significance.

8.17.2.3 Disruption to Visitor Access of Cultural Heritage Sites

In some cases, Project activities may obstruct visitor access to cultural heritage sites. This impact is relevant for important monuments, archaeological sites that receive visitors, and sites with ICH value. Depending on the site, this impact may affect tourists and researchers, but it is most likely to affect ICH users. All phases of Project activity may require the temporary blockage of roads or protective measures, such as the fencing off of cultural sites, which will block or limit visitation and use.

This type of impact is most likely to occur during the construction phase, especially around roads under renovation, under construction, or intersecting the pipeline construction front. Blockage of access may occur in the operation phase, as a result of repairs or maintenance to block valve systems, the pipeline, or other associated facilities during the operation phase of the Project. Disruption to visitor access of cultural heritage sites along/within vicinity of the pipeline route is not anticipated to occur during the decommissioning phase, as no roads should need to be upgraded or constructed, as roads are the primary source of access restriction.

The two sites, an ancient tomb (CH-250-E) and an area with settlement remains in Kavissos (CH-352-E) located within 50m from logistic roads are not expected to sustain any direct impacts as these are pre-existing roads.
Disruption to visitor access is also relevant to CH sites intersecting the project footprint due to possible blockage of access roads and/or temporary fencing off of sites. These include: a stone paved road in Palagia (CH-394-E) intersecting pipeline trench and possibly the centreline; an observation post in Sykorachi (CH-334-E) intersecting the minimum working strip and possibly the centreline; a low to medium density pottery scatter near Pamforo (CH-353-E); a low density pottery and stone scatter, including a rising of the ground possibly indicating a mound (CH-354-E). In addition, visitor access disruption may be induced for the following sites:

- The Justinian Walls and Aqueduct (CH-36-E), near KP 123, is an officially recognized archaeological site, which intersects the centreline.
- The site of Paradeisos - Kilisi Tepe (CH-12a-E), near KP 154, an officially recognized prehistoric settlement, intersects the regular working strip.
- The Toumpa of Perni (CH-11a-E), near KP 168, outside the regular working strip (approximately 55 m from the centreline). It is a settlement of the Prehistoric and Historic Times and cemetery of the Post-Roman and Byzantine Period, discovered during the construction activities of the natural gas pipeline at 2000.
- In the area of Pondolivado (CH-10a-E), near KP 172, the officially recognized archaeological site of Ancient Pistiros (settlement and findings of the Classical and Hellenistic period) intersects the minimum working strip.
- The ancient town of Nea Komi, an officially recognized archaeological site (CH-13a-E), near KP 176, intersects the centreline.
- The Wall of Kavala (CH-4LK-E), near KP 178, intersects the centreline. It is an officially recognized monument of the Byzantine, Post-Byzantine period.
- ‘Archaeological Area of Filippoi’ (CH-73LK-E), near KP 195. The pipeline passes at a distance of approximately 66 m from the boundaries of the archaeological site of Filippoi and of the suggested protection zone A of Dikili Tas.

User access issues due to temporary blockage of roads leading to sites may occur at a road shrine in Amfitriti (CH-336-E), an unknown church in Palagia (CH-370-E), a WWII pillbox in Sykorachi (CH-333-E), at the Church of the Assumption (CH-115) and the Church of Ayios Rafail (CH-88). As it appears construction fronts will cut off access roads leading to these sites.
It should be noted that not every part of any particular site will suffer from access problems or difficulties. For example, access to the Justinian Walls and Aqueduct (CH-36-E), near KP 123, will be mostly unhindered and only a very small section will be inaccessible for a limited time.

No blockage of access is assessed during the operation phase, as a result of repairs or maintenance to block valve systems, the pipeline, or other associated facilities during the operation phase of the Project. During the decommissioning phase disruption to visitor access of cultural heritage sites along access roads is not anticipated to occur, as no roads should need to be upgraded or constructed, since roads are the primary source of access restriction. Access might be hindered to sites within 50m from project facilities that will require decommissioning such as the sporadic pottery in Amfitirti, (CH-376-E), located close to BVS02.

8.17.2.4 Detrimental Effects on the Setting or Ambience of Cultural Heritage Sites

Cultural heritage sites are closely related to the surrounding landscape and viewed. Impacts on the setting or ambience of a cultural heritage site can affect its value to visitors and users. This type of impact affects visitors to monuments, popular archaeological sites, and users of sites with ICH value. In some instances, this can be a permanent impact if the landscape has been altered enough to change its visual character. An example of this will be the construction of large, permanent structures adjacent to a cultural heritage site that receives visitors. In other instances, the impacts may be temporary if they are related to construction or maintenance activities or non-permanent structures. Examples of temporary impacts are the placement of equipment near a monument, or Project-related noise near a place of worship.

Impacts on site setting may occur anywhere Project activities are taking place, including during construction, operation and decommissioning, since issues such as noise, vibration, and the movement of vehicles, machinery and personnel may contribute to a change in site setting. Because the pipeline will be underground, most sites in the study area are not at risk for permanent impacts on setting and landscape. Long term impacts on landscape, however, are likely to occur in locations within the study area that involve the construction of permanent structures, such as areas near the BVSs or the Compressor Stations, since these facilities will change the character of the surrounding landscape. During the operations phase, impacts on the setting and ambience of sites will be expected to occur at the block valve stations, which require periodic maintenance and the Compressor Stations, where every day operational works will take
place. During the decommissioning phase, the setting or ambience of visited sites located near Project facilities could experience negative effects from decommissioning activities.

During construction all the previously mentioned sites that are assessed to experience disruption to visitor access, will induce some level of impact. In addition, the chapel of Aghios Markos in Palagia (CH-339-E) might incur some impacts. Nevertheless, since the impact will be temporary, no detrimental effects on the setting or ambience of the sites are estimated. It should be noted, that for significant part of its length, the pipeline crosses well established agricultural lands, which are able to absorb any impacts on the landscape and the surroundings of the cultural heritages resources.

Detrimental long term effects on setting and ambience are expected to occur at sites intersecting or within 50m from permanent Project facilities. Construction of permanent structures for the compressor station can disrupt the perception of the landscape.

Other sites that will sustain impacts to their setting or ambience are monuments and sites with ICH value located along logistic roads. Cultural heritage sites within 50 m of logistic roads and within the 2 km wide corridor include: a road shrine in Amfiritri (CH-336-E) near KP 46; a fire tower in an ICH / AHAP area (CH-334-E) near KP 57, and a pillbox (CH-333-E) near KP 59 at Sykorrachi; chapels (CH-125, CH-162 & CH-213), churches (CH-88, CH-121, CH-79, CH-215, CH-212, CH-137, & CH-214), the Monastery of Virgin Mary (CH-130), and a recreational area (CH-80). The Church of the Assumption (CH-115) is located both alongside a logistic road and within 50 m of the pipeline, increasing the likelihood of impacts.

8.17.3 Mitigation Measures

8.17.3.1 Direct Physical Disturbance or Damage to the Sites

- Pre-construction mitigation will include aerial image analysis along the base case route to identify potential areas of interest for further investigation. Where available, historic maps will be compared to the results of the remote sensing analyses. The Project will also engage local landowners in areas of interest to ascertain whether results of analyses indicate potential subsurface ancient structures or more recent land use patterns. Relevant GIS layers will be produced to allow for an integrated assessment of visual analysis and
historic data. The findings of this pre-construction mitigation may lead to intrusive testing in confirmed areas of interest.

- Avoidance of known cultural heritage sites through Project design, if technically feasible. Avoidance, through additional local re-routings or relocations, is the preferred mitigation method and will be considered along with the mitigation measures listed below.

- In case avoidance is not possible, special crossing method for linear cultural heritage resources may be implemented. This crossing method will be determined after further site evaluation and in agreement with the competent authorities.

- The condition and structural integrity of sites with above-ground components located in proximity to the Project footprint will be recorded prior to construction.

- For archaeological sites, the Project will engage the appropriate Greek authorities in further evaluation of sites and the use of intrusive and non-intrusive methods.

- Where it is not possible to avoid monuments or sites with ICH value (i.e. those locations where the working strip is already reduced to the minimum width and cannot be deviated), relocation, replacement and compensation will be considered and discussed as options with relevant stakeholders.

- Sites that lie within 50 m of Project construction footprint will be conspicuously marked and protected with temporary barriers such as a bright coloured plastic or mesh wire fence with highly visible flagging or tape attached to it. Areas of high archaeological potential will be marked for avoidance, particularly during wet conditions.

- In areas of high archaeological potential inside the working strip, construction will be prohibited in very wet conditions. These conditions will occur following episodes of very heavy rain, most likely during the rainy season.

- Chance Finds Procedures will be implemented on active construction fronts. This includes the monitoring of construction activities by a professional archaeologist and the commitment to temporarily stop work in the vicinity of any new archaeological discovery. Construction activities at a chance find will resume after the implementation of government-approved mitigation measures. If archaeological rescue is required at a chance find, the rescue will be conducted according to international and Greek standards and with oversight and involvement of the appropriate government institutions.

- Inclusion of guidelines in the workers’ Code of Conduct to prohibit employee activities that might interfere with or damage nearby cultural heritage sites.

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73 ‘Rescue’ archaeology occurs on sites about to be destroyed but, on occasion, may include in situ preservation of any finds or protective measures taken to preserve an unexcavated site.
8.17.3.2 Degradation or Damage to Cultural Heritage Sites Due to Pollution or Vibration

- Avoidance through Project design of standing structures, such as historic buildings, monuments, and archaeological sites with above-ground features. Avoidance, through additional local re-routings or relocations, is the preferred mitigation method and will be considered along with the mitigation measures listed below.

- The condition and structural integrity of sites with above-ground components located in proximity to the Project footprint will be recorded prior to construction.

- Some forms of pollution can be damaging to stone architecture. If structural assessment indicates a risk of impacts from pollution, a site will be covered or otherwise protected from potential impacts. If dust is the issue, dust-minimizing strategies, such as spraying, may be used around the at-risk site. In the case that a site of cultural value is damaged due to Project-related pollution, the site will be cleaned by professional conservators and protected from further damage.

- Structural damage from vibration can exacerbate the already diminished structural integrity of ancient or historic buildings. If structural assessment indicates that a site is at risk of impacts from vibration, the site will be structurally reinforced or otherwise stabilized and protected from such impacts (i.e. structural bracing, use of dampening strips or tuned dampers to reduce the propagation of vibration through historic buildings, or cement reinforcement).

- The condition and structural integrity of the above-ground features will be monitored periodically for signs of degradation caused by vibration and for signs of pollution (most commonly in the form of dust and soot).

- The Project will use low impact construction alternatives, when feasible. Ripping may be used as an alternative to blasting near structures identified as at risk for impacts from vibration. Other techniques, such as bored piling or the use of a hammer cushion when driving steel piles may be used to minimize the vibration generated. Low impact demolition methods, such as the use of hydraulic rock splitters rather than rock breakers, will also be applied where possible.

- The most severe vibrations associated with road traffic result from heavy vehicles with stiff suspensions moving rapidly along roads with irregular surfaces. Vibration-minimizing techniques will be implemented for nearby structures identified as at risk of impacts from vibration. Vibration-minimizing techniques for road traffic include: restriction of vehicle velocity, minimization of surface irregularities (potholes, manhole covers, washboards, cobblestones) by road improvements or re-surfacing, increase in stiffness of the road surface and its sub-base, and installation of isolation pads over limited sections of a road.
Vibrations to subsurface features are more severe in wet conditions. In very wet conditions, the Project will prohibit construction in the vicinity of structures identified as at risk for vibration impacts. These conditions will occur following episodes of very heavy rain which will most likely occur during the rainy season (November 1st – April 15th).

In the case that a part or all of a cultural heritage site is damaged due to excessive vibration, conservation specialists will be called in immediately to repair the structure with conventional conservation techniques.

8.17.3.3 Disruption to Visitor Access of Cultural Heritage Sites

Disruption of visitor access, particularly to important monuments and sites with ICH value, is likely to cause community issues. Where feasible, Project equipment and activities will be planned and placed to avoid restricting site access. Avoidance is the preferred mitigation method and will be considered along with the mitigation measures listed below.

Consultation with cultural heritage site users, through a community liaison team, to understand site usage and how the Project may affect the visitor’s access.

Community liaison team will be responsible for managing access to any potential visitor (including professional researchers, local community groups, schools, etc.), conditionally that all HSE issues are covered.

In the case that access to an important cultural heritage site is restricted or blocked, the Project will arrange alternative access using stakeholder input, and will notify the public of any disruptions, and alternative measures for visitor’s access will be coordinated with the relevant authorities.

8.17.3.4 Negative Effects on the Setting or Landscape of Cultural Heritage Sites

Where feasible, the Project will avoid cultural heritage sites through Project design to ensure limited impacts on the setting and landscape of these sites. Avoidance is the preferred mitigation method and will be considered along with the mitigation measures listed below.

Consultation with site users through a community liaison team to understand site use, site boundaries, and timing of religious and cultural activities that could be affected by construction, operation or decommissioning activities.
- Noise and vibration will be periodically monitored at cultural heritage sites that receive visitors within the study area of influence.

- Inclusion of guidelines in workers' Code of Conduct to prohibit employee activities that might interfere with or damage nearby cultural heritage sites.

- Restrict the timing of construction, maintenance, and demolition activities (during the decommissioning of the project) so as not to disturb the use of cultural heritage sites. Stop work at certain times when sites are in use, such as during significant events (such as weddings or religious festivals). For example, construction in proximity to the Church of the Assumption (CH-115) will halt on August 15\textsuperscript{th}, the date of a known religious festival that will take place at the church. Additional days and times of construction restrictions will be established through pre-construction stakeholder consultation.

- Project will be designed to mitigate negative aesthetic and auditory impacts caused by facilities. The following techniques will be considered: noise-reducing barriers, low-profile constructions, proper siting and location to maximize the use of topography and vegetation, screening, blending with topographic forms and existing vegetation patterns, and use of environmental coloration or advanced camouflage techniques to limit visual effects.

- In order to address and mitigate any unforeseen impacts, community consultation, through a community liaison group, will take place throughout the life of the Project. If local concerns related to cultural heritage are brought up through the consultation process, the Cultural Heritage specialists group will coordinate with Social specialists to address concerns and mitigate potential impacts. A grievance mechanism will also be in place as an outlet for local people to express complaints about the Project. If the grievance mechanism records any criticisms related to the Project's management of cultural heritage, the Cultural Heritage group will coordinate with the community liaison representative and TAP AG will respond to the grievance accordingly.

8.17.3.5 Residual Impacts

As discussed in the cultural heritage impacts assessment criteria (Section 5.9), the significance of cultural heritage impacts is the product of the magnitude of the impact and the value of the resource. The value of a cultural heritage resource is represented in the importance rating of the site (High, Moderate, or Low). The criteria for calculating impact significance are presented in Table 8-102.
**Table 8-102 Significance of Impacts on Cultural Heritage**

<table>
<thead>
<tr>
<th>Magnitude of impact</th>
<th>Negligible</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negligible</td>
<td>No change in the condition, accessibility or setting of the resource</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Resource is not recognised by local people or external parties as being of value to community or for scientific or cultural research</td>
<td>Not significant</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Medium</td>
<td>Resource is important locally, recognised over wider area (regionally or nationally), or has moderate interest for research</td>
<td>Not significant</td>
<td>Minor significance</td>
<td>Moderate significance</td>
</tr>
<tr>
<td>High</td>
<td>Resource is essential to way of life or identity, or is of great interest for research</td>
<td>Not significant</td>
<td>Moderate significance</td>
<td>Major significance</td>
</tr>
</tbody>
</table>

Source: ERM (2012)

The significance of potential impacts is calculated for this assessment based on the criteria above. It was estimated that residual impacts for non-avoidance mitigation decrease by one level the original potential impact significance rating. For example, a medium importance...
archaeological site within the Project footprint (large magnitude impact) will sustain an unmitigated impact of Major significance. If the impact on the site was mitigated through archaeological rescue, however, a portion of the site’s scientific information could be recorded, reducing the impact rating from Major to a Moderate residual impact. Impacts have been analysed based on the site’s distance to the closest relevant Project component.

The Project’s area of influence for cultural heritage sites includes the Project footprint (pipeline trench, access roads, pipe yards, camp sites, compressor stations and block valve stations) and a 50 m buffer zone around the Project footprint. The distance for predicted impacts may need to be reconsidered; however, if the effects from vibration prove to extend further distances than currently assumed.

In most cases, if a site was avoided by more than 50 m, impacts will not be significant. However, avoidance is not always technically feasible. For this reason, residual impacts have been calculated to reflect implementation of non-avoidance mitigation measures. It is important to note that if avoidance of physical impacts on a resource is feasible, other types of impacts may in turn become relevant. However, the assessment aims to provide a comprehensive summary of all potential impacts, regardless of the possible mitigation measures expect to be implemented. For example, if direct physical impacts are avoided by a minor re-route, vibration and dust might become the main sources of impact on the resource. Since the site-specific mitigation strategy to be applied in each case is uncertain, the assessment addresses all potential impacts to cultural heritage sites independently.

The cultural heritage impact assessment does not include an assessment of contemporary cemeteries, as this topic will be handled in the social section. The chance finds procedure, built into the ESMMP, however, will cover events of unmarked human burials uncovered as chance finds.

8.17.3.6 Construction and Pre-commissioning Phase

The construction phase is expected to produce the highest number of impacts as well as the most significant impacts. This is due to the potential for direct physical impacts on cultural heritage sites, which may occur anywhere within the study area as a result of the movement of heavy vehicles and machinery and their ground-disturbing construction activities. Direct physical
impacts will produce the most significant residual impacts on cultural heritage. Mitigation measures to avoid direct physical impacts will take priority over mitigation for indirect impacts. Avoidance of sites is always the preferred mitigation measure. Impacts on cultural heritage sites have already been mitigated, in significant extent, through Project design. For few cases, additional rerouting or relocation is suggested as mitigation measure.

Sites that are expected to receive impacts include: part of an aqueduct system in Amfitriti (CH-335-E) intersecting the minimum working strip and possibly the centreline; an extensive pottery scatter in Sykorachi (CH-388-E) within minimum working strip; a stone paved road in Palagia (CH-394-E) intersecting pipeline trench and possibly the centreline. In addition to these, a pottery scatter in Thrylorio (CH-391-E) intersecting the pipeline trench and centreline and an area possibly connected to the official site of Alonia/ Peristerias (CH-3-E), near KP 259 should also be considered at risk of moderate significance. Sites that are expected to receive some minor impacts due to direct physical disturbance include: the Justinian Walls and Aqueduct (CH-36-E), near KP 123; ‘Paradeisos – Kilisi Tepe’ site (CH-12a-E), near KP 154; the Wall of Kavala (CH-4LK-E); and Hill of Toumpa, at Nea Zichni (CH-23LS-E), near KP 244.

Vibration and dust, due to blasting, hammering, and the movement of heavy machinery and vehicles, are also source of impacts on above-ground cultural heritage structures. Vibration and dust impacts are expected to occur at cultural heritage sites located along logistic roads. Cultural heritage sites were identified along a number of roads of the 3rd and 4th class to be utilized by the Project. Sites within approximately 50 m from the edge of logistic road are anticipated to sustain indirect physical impacts during construction and decommissioning. Indirect physical impacts are anticipated on a part of an aqueduct system in Amfitriti (CH-335-E) intersecting the minimum working strip and possibly the centreline; a road shrine dedicated to Virgin Mary (CH-336-E), near to KP 41; the chapel of Agios Markos near KP 46 (CH-339-E); the Justinian Walls and Aqueduct (CH-36-E), near KP 123; and the Wall of Kavala (CH-4LK-E), near KP 178. Kastro bridge (CH-83) and the Church of the Assumption (CH-115) are located on unpaved roads (road class 4). Unpaved roads such as these are expected to produce more vibration from the movement of heavy vehicle traffic. Pre-construct mitigation, including a structural condition assessment, bracing (if necessary) and monitoring are particularly important in these sites.

Disruption of visitor access may occur temporarily during construction where construction activities block off roads that allow visitors to access cultural heritage sites. Impacts may incur to
a road shrine in Amfitriti (CH-336-E), near KP 47; a chapel near KP 45 (CH-370-E); the Wall of Kavala (CH-4LK-E), near KP 178 and ‘Archaeological Area of Filippoi (CH-73LK-E), near KP 195. The Church of Ayios Rafail in Maniaki (CH-88) and the Church of the Assumption (CH-115) are likely to be temporarily impacted by construction fronts that will block roads leading to them. The users of these churches, however, will be able to inform the Project of potential access issues more accurately. Site access is an issue that should be discussed with stakeholders.

Site setting and ambience is expected to be impacted temporarily during the construction phase by construction activities and movement of vehicles and personnel. Temporary impacts are expected to a road shrine in Amfitriti (CH-336-E). The setting and ambience of recreational area close to Ano Grammatiko (CH-80) is expected to be impacted by heavy vehicle traffic. CH-80 is located adjacent to the road in a clearing. The relaxing natural setting of the recreational area is expected to be altered by the frequent passing of large vehicles. During the construction phase, mitigation of impacts on site setting is best handled by methods developed through community consultation.

Figure 8-31 to Figure 8-42 illustrate the locations and significance of residual impacts anticipated to occur as a result of construction phase activities. Direct physical impacts, shown in Figure 8-31 to Figure 8-33, represent the greatest potential residual impacts. The indirect impacts from vibration, pollution, disruption of user access, and change in site setting, produce impacts which are less in number and significance.

Table 8-103 presents a summary of mitigation measures and anticipated residual impacts for the construction and pre-commissioning phase.
Figure 8-31  Locations and Significance of Residual Direct Physical Impacts – Cultural Heritage – Construction East (a)

Source: APROFOS (2013)
Figure 8-32 Locations and Significance of Residual Direct Physical Impacts – Cultural Heritage – Construction East (b)

Source: ASPROFOS (2013)
Figure 8-33 Locations and Significance of Residual Direct Physical Impacts – Cultural Heritage – Construction West

Source: ERM (2012)
Figure 8-34  Locations and Significance of Residual Pollution and Vibration Impacts – Cultural Heritage Construction East (a)

Source: ASProfessor (2013)
Figure 8-35  Locations and Significance of Residual Pollution and Vibration Impacts – Cultural Heritage Construction East (b)

Source: APROFOS (2013)
Figure 8-36  Locations and Significance of Residual Pollution and Vibration Impacts – Cultural Heritage Construction West

Source: ERM (2012)
Figure 8-37  Locations and Significance of Residual User Access Impacts – Cultural Heritage Construction East (a)

Source: ASPROFOS (2013)
Figure 8-38  Locations and Significance of Residual User Access Impacts – Cultural Heritage Construction East (b)

Source: APROFOS (2013)
Figure 8-39 Locations and Significance of Residual User Access Impacts – Cultural Heritage Construction West

Source: ERM (2012)
Figure 8-40  Locations and Significance of Residual Setting and Ambience Impacts – Cultural Heritage Construction East (a)

Source: ASPROFOS (2013)
Figure 8-41  Locations and Significance of Residual Setting and Ambience Impacts – Cultural Heritage Construction East (b)

Source: APROFOS (2013)
Figure 8-42 Locations and Significance of Residual Setting and Ambience Impacts – Cultural Heritage Construction West

Source: ERM (2012)
### Table 8-103  Residual Impacts - Cultural Heritage - Construction and Pre-Commissioning

<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| 11  | Direct physical disturbance of or damage to archaeological sites within 50 m from Regular working strip | • Further research and Site Evaluation  
• Avoidance  
• Government engagement  
• Marking and protection  
• Rescue  
• Minimum working strip  
• Guidance in Code of Conduct  
• Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) | NOT SIGNIFICANT  
• Site is of high importance. Location/characteristics unsafe  
• May extend into the Minimum Working Strip  
• With mitigation, physical impacts will be not significant. |
|     | Site affected: CH-350-E                                                      |                                                                                                       |                                       |
| 21-22| Direct physical disturbance of or damage to archaeological site at the edge of the regular working strip. |                                                                                                       |                                       |
|     | Site affected: CH-347-E                                                      |                                                                                                       |                                       |
| 21-22| Direct physical disturbance of or damage to archaeological sites at the edge of the regular working strip. |                                                                                                       |                                       |
|     | Site affected: CH-346-E                                                      |                                                                                                       |                                       |
| 25-26| Direct physical disturbance of or damage to archaeological site intersecting the pipeline regular working strip, the pipeline trench and possibly the centreline. |                                                                                                       | MINOR  
• Site is of low importance and intersects the Project footprint  
• With mitigation, construction in these areas will cause a minimum loss of some scientific/historic/archaeological/cultural value, if any |
|     | Site affected: CH-383-E                                                      |                                                                                                       |                                       |
| 42  | Direct physical disturbance of or damage to archaeological site within 50 m from pipeline regular working strip, possibly intersecting BVS 2. |                                                                                                       | NOT SIGNIFICANT  
• Site is of high importance. Location/characteristics unsafe  
• With mitigation, physical impacts will be not significant. |
|     | Site affected: CH-376-E                                                      |                                                                                                       |                                       |
| 46-47| Direct physical disturbance of or damage to ICH within 50 m from Regular working strip |                                                                                                       | NOT SIGNIFICANT  
• Site is of high importance. Location/characteristics unsafe  
• With mitigation, physical impacts will be not significant. |
<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| 46-47| Direct physical disturbance of or damage to an ICH site intersecting the pipeline minimum working strip, the pipeline trench and possibly the centreline | - Evaluation  
- Avoidance  
- Further site evaluation  
- Government engagement  
- Marking and protection  
- Rescue  
- Guidance in Code of Conduct  
- Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure)  
- Special crossing method shall be investigated | MODERATE  
- Site of high importance and intersects the Project footprint  
- With mitigation, physical impacts will be moderate. |
|      | Site affected: CH-394-E                                                                                                                        |                                                                                                       |-------------------------------------------------------------------------------------------------------|
| 56-57| Direct physical disturbance of or damage to an ICH, AHAP site intersecting the pipeline minimum working strip and possibly the pipeline trench or the centreline | - Evaluation  
- Avoidance (possible minor local rerouting)  
- Further site evaluation  
- Government engagement  
- Marking and protection  
- Rescue  
- Guidance in Code of Conduct  
- Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) | NOT SIGNIFICANT  
- Sites of high importance and intersects the Project footprint  
- With mitigation, physical impacts will be not significant. |
|      | Site affected: CH 334-E                                                                                                                        |                                                                                                       |-------------------------------------------------------------------------------------------------------|
| 62-63| Direct physical disturbance of or damage to archaeological site located at the edge of the pipeline regular working strip, possibly extending to the pipeline trench | - Avoidance  
- Evaluation  
- Further site evaluation  
- Government engagement  
- Marking and protection  
- Rescue  
- Minimum working strip | NOT SIGNIFICANT  
- Site is of high importance. Location/characteristics unsafe  
- With mitigation, physical impacts will be not significant. |
<p>|      | Site affected: CH-389-E                                                                                                                        |                                                                                                       |-------------------------------------------------------------------------------------------------------|</p>
<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| 62-63| Direct physical disturbance of or damage to archaeological site intersecting the pipeline minimum working strip and possibly the pipeline trench or the centreline | - Evaluation  
- Avoidance  
- Further site evaluation  
- Government engagement  
- Marking and protection  
- Rescue  
- Guidance in Code of Conduct  
- Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) | MODERATE  
- Site of high importance and intersects the Project footprint  
- With mitigation, physical impacts will be moderate. |
|      | Site affected: CH-388-E                                                       |                                                                                                       |                                                                                                     |
| 62-63| Direct physical disturbance of or damage to archaeological site intersecting the pipeline minimum working strip and possibly the pipeline trench or the centreline | - Evaluation  
- Avoidance  
- Further site evaluation  
- Government engagement  
- Marking and protection  
- Rescue  
- Guidance in Code of Conduct  
- Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) | MODERATE  
- Sites of high importance and intersects the Project footprint  
- With mitigation, physical impacts will be moderate. |
|      | Site affected: CH-335-E                                                       |                                                                                                       |                                                                                                     |
| 83-84| Direct physical disturbance of or damage to archaeological sites at the edge of the regular working strip. | - Further research and Site Evaluation  
- Avoidance  
- Government engagement  
- Marking and protection  
- Rescue  
- Minimum working strip  
- Guidance in Code of Conduct  
- Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) | NOT SIGNIFICANT  
- Sites are of high importance located at the edge of regular working strip.  
- With mitigation, physical impacts will not be significant. |
|      | Site affected : CH-354-E                                                      |                                                                                                       |                                                                                                     |
| 83-84| Direct physical disturbance of or damage to archaeological site within 50 m from pipeline regular working strip, possibly extending to the regular working strip. | - Further research and Site Evaluation  
- Avoidance  
- Government engagement  
- Marking and protection  
- Rescue  
- Minimum working strip  
- Guidance in Code of Conduct  
- Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) | MINOR  
- Site is of medium importance and intersects the Project footprint  
- With mitigation, construction in these areas will cause a minimum loss of some scientific/ historic/ archaeological/ cultural value, if any |
<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>86-87</td>
<td>Direct physical disturbance of or damage to archaeological site intersecting the pipeline trench and centreline</td>
<td>• Site affected: CH-391-E</td>
<td>MODERATE&lt;br&gt;• Site of medium importance with high archaeological potential within 50 m from centreline though outside regular working strip.&lt;br&gt;• With mitigation, physical impacts will be moderate.</td>
</tr>
<tr>
<td>110</td>
<td>Direct physical disturbance of or damage to AHAP intersecting the Reduced working strip</td>
<td>• Site affected: CH-34-E</td>
<td>NOT SIGNIFICANT&lt;br&gt;• Site is of low importance. Location/characteristics unsafe&lt;br&gt;• With mitigation, physical impacts will be not significant.</td>
</tr>
<tr>
<td>119</td>
<td>Direct physical disturbance of or damage to AHAP intersecting the Reduced working strip</td>
<td>• Site affected: CH-33-E</td>
<td>MINOR&lt;br&gt;• Site of high importance and intersects the Project footprint&lt;br&gt;• The use of special crossing method (trenchless crossing method, as the one used for the existing DESFA pipeline) will minimize impacts on the resource, if any.</td>
</tr>
<tr>
<td>123</td>
<td>Direct physical disturbance of or damage to archaeological site intersecting the pipeline trench and centreline</td>
<td>• Site affected: ‘Justinian Walls and Aqueduct’ CH-36-E</td>
<td>• Evaluation&lt;br&gt;• Avoidance&lt;br&gt;• Further site evaluation&lt;br&gt;• Government engagement&lt;br&gt;• Marking and protection&lt;br&gt;• Rescue&lt;br&gt;• Guidance in Code of Conduct&lt;br&gt;• Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure)&lt;br&gt;• Special crossing method shall be investigated</td>
</tr>
<tr>
<td>136</td>
<td>Direct physical disturbance of or damage to archaeological site at the edge of the regular working strip</td>
<td>• Site affected: ‘Banks of Kossinthos’ CH-25a-E</td>
<td>MINOR&lt;br&gt;• Site of high importance without known boundaries.&lt;br&gt;• The pipeline bundles with existing pipeline.&lt;br&gt;• With mitigation, construction in these areas will cause a minimum loss of some scientific/historic/archaeological/cultural value, if any</td>
</tr>
</tbody>
</table>
### Project Title:
Trans Adriatic Pipeline – TAP

### Document Title:
Integrated ESIA Greece
Section 8 - Assessment of Impacts and Mitigation Measures

<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>136</td>
<td>Direct physical disturbance of or damage to AHAP at the edge of the Regular working strip</td>
<td>Conduct</td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-25-E</td>
<td>• Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure)</td>
<td>• Site is of medium importance. Location/ characteristics unsafe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• With mitigation, construction in these areas will cause a minimum loss of some scientific/ historic/ archaeological/ cultural value, if any</td>
</tr>
<tr>
<td>147</td>
<td>Direct physical disturbance of or damage to AHAP intersecting the Regular working strip</td>
<td></td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-20-E</td>
<td></td>
<td>• Site is of medium importance. Location/ characteristics unsafe.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• With mitigation, physical impacts will be not significant.</td>
</tr>
<tr>
<td>150</td>
<td>Direct physical disturbance of or damage to AHAP at the edge of the Regular working strip</td>
<td></td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>Site affected: ‘Hill of Ephoroon’ CH-18-E</td>
<td></td>
<td>• Designated site of high importance. The pipeline crosses the outskirts of the site.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• HDD will be performed for the NestosRiver crossing. The site is close and will be also avoided.</td>
</tr>
<tr>
<td>154</td>
<td>Direct physical disturbance of or damage to archaeological site intersecting the regular working strip</td>
<td></td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>Site affected: ‘Paradeisos – Kilisi Tepe’ CH-12a-E</td>
<td></td>
<td>• Sites of high importance that will be avoided by the pipeline.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• With mitigation, construction in these areas will cause a minimum loss of some scientific/ historic/ archaeological/ cultural value, if any</td>
</tr>
<tr>
<td>172</td>
<td>Direct physical disturbance of or damage to archaeological site intersecting the minimum working strip</td>
<td></td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>Site affected: ‘Pondolivado’ CH-10a-E</td>
<td></td>
<td>• Sites of high importance that will be avoided by the pipeline.</td>
</tr>
<tr>
<td>176</td>
<td>Direct physical disturbance of or damage to archaeological site intersecting the minimum working strip</td>
<td></td>
<td>• With mitigation, construction in these areas will cause a minimum loss of some scientific/ historic/ archaeological/ cultural value, if any</td>
</tr>
<tr>
<td></td>
<td>Site affected: ‘Nea Komi’ CH-13a-E</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### KP 178
**Impact / Risk:** Direct physical disturbance of or damage to archaeological site intersecting the pipeline trench and centreline
**Site affected:** ‘Wall of Kavala’ CH-4LK-E

- Evaluation
- Avoidance (possible local rerouting or special crossing method as will be decided based on further consultation with competent authority)
- Further site evaluation
- Government engagement
- Marking and protection
- Rescue
- Guidance in Code of Conduct
- Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure)

**Significance of Residual Impact / Risk:** MINOR
- Site of high importance
- With mitigation, construction in these areas will cause a minimum loss of some scientific/historic/archaeological/cultural value, if any

### KP 240
**Impact / Risk:** Direct physical disturbance of or damage to archaeological site intersecting the minimum working strip
**Site affected:** ‘Athanato Nero’ CH-19LS-E

- Evaluation
- Avoidance (local rerouting)
- Further site evaluation
- Government engagement
- Marking and protection
- Rescue
- Guidance in Code of Conduct
- Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure)

**Significance of Residual Impact / Risk:** NOT SIGNIFICANT
- Site of high importance avoided by the pipeline.
- With mitigation, physical impacts will be not significant.

### KP 244
**Impact / Risk:** Direct physical disturbance of or damage to archaeological site intersecting the pipeline trench and centreline
**Site affected:** ‘Hill of Toumpa’ CH-23LS-E

- Evaluation
- Avoidance
- Further site evaluation
- Government engagement
- Marking and protection
- Rescue
- Guidance in Code of Conduct

**Significance of Residual Impact / Risk:** MINOR
- Site of high importance.
- The pipeline bundles with existing pipeline and passes through the outskirts of the designated area.
- With mitigation, construction in these areas will cause a minimum loss of some scientific/historic/archaeological/cultural value, if any
<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>268</td>
<td>Direct physical disturbance of or damage to AHAP intersecting the pipeline trench and centreline</td>
<td>Conduct • Cultural Heritage Management Plan (archaeological monitoring and &quot;chance finds&quot; procedure)</td>
<td>MODERATE • Site of high importance. The pipeline bundles with existing pipeline. • Field survey revealed that the area is located on a mound with ceramic scatters in low density, probably connected to the officially recognized archaeological site of Alonia/Peristerias. • With mitigation, physical impacts will be moderate.</td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-3-E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>360</td>
<td>Direct physical disturbance of or damage to archaeological site at the edge of the Regular working strip</td>
<td></td>
<td>NOT SIGNIFICANT • Site is of high importance. • With mitigation, physical impacts will be not significant.</td>
</tr>
<tr>
<td></td>
<td>Site affected: 'Pentalofos' CH-31LT-E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>366.1</td>
<td>Direct physical disturbance of or damage to archaeological sites intersecting the centreline or Reduced Working Strip</td>
<td></td>
<td>MINOR • Site is of low importance and intersect the project footprint • Even with mitigation, construction in these areas will cause a loss of some important scientific/historic/archaeological/cultural value</td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>418.7</td>
<td>Direct physical disturbance of or damage to archaeological sites within 50 m of the centreline</td>
<td></td>
<td>NOT SIGNIFICANT • Site located far enough away from Project footprint to avoid significant direct physical impacts with mitigation</td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>419.4</td>
<td>Direct physical disturbance of or damage to archaeological sites within 50 m of the centreline</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>421</td>
<td>Direct physical disturbance of or damage to archaeological sites intersecting the pipeline trench or Reduced Working Strip</td>
<td></td>
<td>MODERATE • Site is of medium importance and intersects the pipeline trench or Reduced Working Strip • Even with mitigation, construction in these areas will cause a loss of some important scientific/historic/archaeological/cultural value</td>
</tr>
<tr>
<td>KP</td>
<td>Impact / Risk</td>
<td>Measures to Address the Impact / Risk</td>
<td>Significance of Residual Impact / Risk</td>
</tr>
<tr>
<td>------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------</td>
</tr>
</tbody>
</table>
| 423.5 | Direct physical disturbance of or damage to archaeological sites intersecting the pipeline trench or Regular Working Strip | • Evaluation  
• Avoidance  
• Further site evaluation  
• Government engagement  
• Marking and protection  
• Rescue  
• Guidance in Code of Conduct  
• Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) | MINOR  
• Site is of medium importance and intersects the Regular Working Strip  
• Even with mitigation, construction in these areas will cause a loss of some scientific/ historic/ archaeological/ cultural value |
|      | Site affected: CH-14                                                          |                                                                                                       |                                        |
| 424.2 | Direct physical disturbance of or damage to archaeological sites within 50 m of the centreline | • Evaluation  
• Avoidance  
• Further site evaluation  
• Government engagement  
• Marking and protection  
• Rescue  
• Minimum working strip  
• Guidance in Code of Conduct  
• Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) | NOT SIGNIFICANT  
• Site is of high importance although located far enough away from Project footprint to avoid significant direct physical impacts with mitigation |
| 424.8 |                                                                                  |                                                                                                       |                                        |
|      | Site affected: CH-231                                                          |                                                                                                       |                                        |
| 443.1 | Direct physical disturbance of or damage to archaeological sites intersecting the centreline or Minimum Working Strip | • Evaluation  
• Avoidance  
• Further site evaluation  
• Government engagement  
• Marking and protection  
• Rescue  
• Guidance in Code of Conduct  
• Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) | MINOR  
• Site is of low importance and intersects the Project footprint  
• Even with mitigation, construction in these areas will cause a loss of important scientific/ historic/ archaeological/ cultural value |
|      | Site affected: CH-16                                                          |                                                                                                       |                                        |
| 443.1 | Direct physical disturbance of or damage to archaeological sites intersecting the centreline or Regular Working Strip | • Evaluation  
• Avoidance  
• Further site evaluation  
• Government engagement  
• Marking and protection  
• Rescue  
• Guidance in Code of Conduct  
• Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) |                                        |
|      | Site affected: CH-17                                                          |                                                                                                       |                                        |
| 443.4 | Direct physical disturbance of or damage to archaeological sites intersecting the centreline or Minimum Working Strip | • Evaluation  
• Avoidance  
• Further site evaluation  
• Government engagement  
• Marking and protection  
• Rescue  
• Guidance in Code of Conduct  
• Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) |                                        |
|      | Sites affected: CH-18                                                          |                                                                                                       |                                        |
### Project Title:
**Trans Adriatic Pipeline – TAP**

### Document Title:
**Integrated ESIA Greece**

**Section 8 - Assessment of Impacts and Mitigation Measures**

<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| 450.2 | Direct physical disturbance of or damage to archaeological sites within 50 m of the centreline | • Avoidance  
• Evaluation  
• Further site evaluation  
• Government engagement  
• Marking and protection | NOT SIGNIFICANT  
• Site located far enough away from Project footprint to avoid significant direct physical impacts with mitigation |

Site affected: CH-347

| 455.4 | Direct physical disturbance of or damage to a monument within approximately 50 m of the centreline | • Rescue  
• Minimum working strip  
• Guidance in Code of Conduct  
• Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) | NOT SIGNIFICANT  
• Site located far enough away from Project footprint to avoid significant direct physical impacts with mitigation |

Site affected: CH-88

| 470.8 | Direct physical disturbance of or damage to archaeological sites within 50 m of the centreline | • Evaluation  
• Avoidance  
• Further site evaluation  
• Government engagement  
• Marking and protection  
• Rescue  
• Guidance in Code of Conduct  
• Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) | NOT SIGNIFICANT  
• Site located far enough away from Project footprint to avoid significant direct physical impacts with mitigation |

Site affected: CH-22

| 475.1 | Direct physical disturbance of or damage to a site with ICH value within 50 m of the pipeline | • Evaluation  
• Avoidance  
• Community consultation  
• Record of structure conditions and monitoring  
• Marking and protection  
• Minimum Working Strip  
• Cultural Heritage Management Plan  
• Guidance in Code of Conduct | NOT SIGNIFICANT  
Church is of high importance located on the edge of the Regular Working Strip  
• With mitigation, physical impacts will be negligible |

Site affected: CH-115

| 485.2 | Direct physical disturbance of or damage to archaeological sites within 50 m of the centreline | • Evaluation  
• Avoidance  
• Further site evaluation  
• Government engagement  
• Marking and protection  
• Rescue  
• Guidance in Code of Conduct  
• Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure) | NOT SIGNIFICANT  
• Site located far enough away from Project footprint to avoid significant direct physical impacts with mitigation |

Site affected: CH-23
### KP 486.5
**Impact / Risk:** Direct physical disturbance of or damage to an archaeological site intersecting the centreline, the pipeline trench or Minimum Working Strip

- Evaluation
- Avoidance
- Further site evaluation
- Government engagement
- Marking and protection
- Rescue
- Guidance in Code of Conduct
- Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure)

**Significance of Residual Impact / Risk:** MINOR
- Site is of low importance and intersect the Minimum Working Strip
- Even with mitigation, construction in these areas will cause a loss of some scientific/historic/archaeological/cultural value

**Site affected:** CH-24

### KP 497.6
**Impact / Risk:** Direct physical disturbance of or damage to archaeological sites within 50 m of the centreline

- Evaluation
- Avoidance
- Further site evaluation
- Government engagement
- Marking and protection
- Large Scale Rescue Investigations (Data Recovery and Public Information Programs)
- Guidance in Code of Conduct
- Cultural Heritage Management Plan (archaeological monitoring and “chance finds” procedure)

**Significance of Residual Impact / Risk:** NOT SIGNIFICANT
- Site located far enough away from Project footprint to avoid significant direct physical impacts with mitigation

**Site affected:** Korissos (CH-29)

### KP 504.1
**Impact / Risk:** Direct physical disturbance of or damage to an archaeological site intersecting the centreline, the pipeline trench or Minimum Working Strip

- Evaluation
- Avoidance if technical feasible, or special crossing method for linear structures
- Further detailed site evaluation
- Government engagement
- Marking and protection
- Large Scale Rescue Investigations (Data Recovery and Public Information Programs)
- Guidance in Code of Conduct

**Significance of Residual Impact / Risk:** MODERATE
- Site is of high importance and intersects the Project footprint
- A Moderate Impact will be assured by the TAP AG’s commitment to avoid resource by redesign after assessment or selection of special crossing methods, or if that is not feasible, to conduct significant interpretive investigations and data recovery with public information sharing programs such as museum exhibits, popular and scientific publications.

**Site affected:** Korissos (CH-30)

### KP 504.3
**Impact / Risk:** Direct physical disturbance of or damage to an archaeological site intersecting the centreline, the pipeline trench or Minimum Working Strip

- Evaluation
- Avoidance if technical feasible, or special crossing method for linear structures
- Further detailed site evaluation
- Government engagement
- Marking and protection
- Large Scale Rescue Investigations (Data Recovery and Public Information Programs)
- Guidance in Code of Conduct

**Significance of Residual Impact / Risk:** MODERATE
- Site is of high importance and intersects the Project footprint
- A Moderate Impact will be assured by the TAP AG’s commitment to avoid resource by redesign after assessment or selection of special crossing methods, or if that is not feasible, to conduct significant interpretive investigations and data recovery with public information sharing programs such as museum exhibits, popular and scientific publications.

**Site affected:** Korissos (CH-31)
### Integrated ESIA Greece

#### Section 8 - Assessment of Impacts and Mitigation Measures

<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>504.4</td>
<td>Direct physical disturbance of or damage to an archaeological site intersecting the centreline, the pipeline trench or Minimum Working Strip</td>
<td>• Cultural Heritage Management Plan (archaeological monitoring and &quot;chance finds&quot; procedure)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site affected: Korissos (CH-32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>505</td>
<td>Direct physical disturbance of or damage to an archaeological site intersecting the centreline, the pipeline trench or Minimum Working Strip</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site affected: Korissos (CH-33)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>512.7</td>
<td>Direct physical disturbance of or damage to archaeological sites within 50 m of the centreline</td>
<td>• Evaluation</td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-35</td>
<td>• Avoidance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Further site evaluation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Government engagement</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Marking and protection</td>
<td></td>
</tr>
<tr>
<td>512.8</td>
<td>Direct physical disturbance of or damage to archaeological sites within 50 m of the centreline</td>
<td>• Rescue</td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-36</td>
<td>• Guidance in Code of Conduct</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Cultural Heritage Management Plan (archaeological monitoring and &quot;chance finds&quot; procedure)</td>
<td></td>
</tr>
<tr>
<td>520.4</td>
<td>Direct physical disturbance of or damage to archaeological sites intersecting the Reduced Working Strip</td>
<td>• Avoidance</td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-38</td>
<td>• Evaluation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Avoidance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Further site evaluation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Government engagement</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Marking and protection</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Rescue</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Minimum working strip</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Guidance in Code of Conduct</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Cultural Heritage Management Plan (archaeological monitoring and &quot;chance finds&quot; procedure)</td>
<td></td>
</tr>
<tr>
<td>KP</td>
<td>Impact / Risk</td>
<td>Measures to Address the Impact / Risk</td>
<td>Significance of Residual Impact / Risk</td>
</tr>
<tr>
<td>----</td>
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<td>--------------------------------------</td>
<td>--------------------------------------</td>
</tr>
</tbody>
</table>
| 21-22 | Degradation of or damage to AS sites within 50 m. from access road due to pollution and vibration | • Avoidance  
• Evaluation  
• Record of structure conditions and monitoring  
• Structural reinforcement?  
• Low impact construction techniques  
• Vibration-minimizing techniques  
• Minimum Working Strip  
• Protection  
• Stop construction (wet conditions, most likely to occur Nov 1- Apr 15)  
• Conservation | NOT SIGNIFICANT  
• Sites are of high importance within 50 m. from centreline  
• With mitigation, anticipated impacts will be not significant |
| Site affected: CH-250-E | | | |
| 41-42 | Degradation of or damage to archaeological site intersecting pipeline minimum working strip and possibly pipeline trench or centreline due to pollution and vibration | • Avoidance  
• Evaluation  
• Record of structure conditions and monitoring  
• Structural reinforcement?  
• Low impact construction techniques  
• Vibration-minimizing techniques  
• Protection  
• Stop construction (wet conditions, most likely to occur Nov 1- Apr 15)  
• Conservation  
• Special crossing method shall be investigated | MINOR  
• Site is of high importance and intersects the Project footprint  
• With mitigation, anticipated impacts will be minor, if any |
| Site affected: CH-335-E | | | |
| 41-42 | Degradation of or damage to ICH site within 50 m. from regular working strip due to pollution and vibration | • Avoidance  
• Evaluation  
• Record of structure conditions and monitoring  
• Structural reinforcement?  
• Low impact construction techniques  
• Vibration-minimizing techniques  
• Minimum Working Strip  
• Protection  
• Stop construction (wet conditions, most likely to occur Nov 1- Apr 15)  
• Conservation | MINOR  
• Sites are of high importance within 50 m. from centreline  
• With mitigation, anticipated impacts will be minor, if any |
| Site affected: CH-336-E | | | |
| 44-45 | Degradation of or damage to ICH site within 50 m. from regular working strip due to pollution and vibration | • Avoidance  
• Evaluation  
• Record of structure conditions and monitoring  
• Structural reinforcement?  
• Low impact construction techniques  
• Vibration-minimizing techniques  
• Minimum Working Strip  
• Protection  
• Stop construction (wet conditions, most likely to occur Nov 1- Apr 15)  
• Conservation | NOT SIGNIFICANT  
• Sites are of high importance within 50 m. from centreline  
• With mitigation, anticipated impacts will be not significant |
<p>| Site affected: CH-370-E | | | |</p>
<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>46-47</td>
<td>Degradation of or damage to an ICH site intersecting the pipeline minimum working strip, the pipeline trench and possibly the centreline due to pollution and vibration</td>
<td>conditions, most likely to occur Nov 1- Apr 15) &lt;ul&gt;&lt;li&gt;Conservation&lt;/li&gt;&lt;/ul&gt;</td>
<td>NOT SIGNIFICANT &lt;ul&gt;&lt;li&gt;Site is of high importance and intersects the Project footprint&lt;/li&gt;&lt;li&gt;With mitigation, anticipated impacts will be not significant&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-394-E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46-47</td>
<td>Degradation of or damage to ICH within 50 m from Regular working strip due to pollution and vibration</td>
<td></td>
<td>MODERATE &lt;ul&gt;&lt;li&gt;Site is of high importance and intersects the Project footprint&lt;/li&gt;&lt;li&gt;Blasting and hammering locations will affect impacts due to vibration&lt;/li&gt;&lt;li&gt;With mitigation, anticipated impacts will be moderate&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td></td>
<td>Site affected : CH-339-E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58-59</td>
<td>Degradation of or damage to ICH within 50 m from the centreline due to pollution and vibration</td>
<td></td>
<td>NOT SIGNIFICANT &lt;ul&gt;&lt;li&gt;Site is of high importance and intersects the Project footprint&lt;/li&gt;&lt;li&gt;With mitigation, anticipated impacts will be not significant&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td></td>
<td>Site affected : CH-333-E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>123</td>
<td>Degradation of or damage to archaeological site intersecting the pipeline trench and centreline due to pollution and vibration</td>
<td>&lt;ul&gt;&lt;li&gt;Avoidance&lt;/li&gt;&lt;li&gt;Special crossing technique&lt;/li&gt;&lt;li&gt;Evaluation&lt;/li&gt;&lt;li&gt;Record of structure conditions and monitoring&lt;/li&gt;&lt;li&gt;Structural reinforcement?&lt;/li&gt;&lt;li&gt;Low impact construction techniques&lt;/li&gt;&lt;li&gt;Vibration-minimizing techniques&lt;/li&gt;&lt;li&gt;Minimum Working Strip&lt;/li&gt;&lt;li&gt;Protection&lt;/li&gt;&lt;li&gt;Stop construction (wet conditions, most likely to occur Nov 1 - Apr 15)&lt;/li&gt;&lt;li&gt;Conservation&lt;/li&gt;&lt;/ul&gt;</td>
<td>MINOR &lt;ul&gt;&lt;li&gt;Site of high importance and intersects the Project footprint&lt;/li&gt;&lt;li&gt;The use of special crossing method (trenchless crossing method, as the one used for the existing DESFA pipeline) will minimize any impacts on the resource.&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td></td>
<td>Site affected : ‘Justinian Walls and Aqueduct‘ CH-36-E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>154</td>
<td>Degradation of or damage to archaeological site intersecting with the regular working strip due to pollution and vibration</td>
<td>&lt;ul&gt;&lt;li&gt;Avoidance&lt;/li&gt;&lt;li&gt;Evaluation&lt;/li&gt;&lt;li&gt;Record of structure conditions and monitoring&lt;/li&gt;&lt;li&gt;Structural reinforcement?&lt;/li&gt;&lt;li&gt;Low impact construction techniques&lt;/li&gt;&lt;/ul&gt;</td>
<td>NOT SIGNIFICANT &lt;ul&gt;&lt;li&gt;Site is of high importance and lie in proximity to vibration and pollution-generating activities&lt;/li&gt;&lt;li&gt;HDD of Nestos River will minimize impacts from vibration or dust&lt;/li&gt;&lt;li&gt;With mitigation, anticipated impacts will be not significant&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td></td>
<td>Site affected : ‘Paradeisos – Kilisi Tepe’ CH-12a-E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KP</td>
<td>Impact / Risk</td>
<td>Measures to Address the Impact / Risk</td>
<td>Significance of Residual Impact / Risk</td>
</tr>
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<td>------------------------------------------------------------------------------</td>
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</tr>
</tbody>
</table>
| 168 | Degradation of or damage to archaeological site outside the regular working strip due to pollution and vibration | • Vibration-minimizing techniques  
• Minimum Working Strip  
• Protection  
• Stop construction (wet conditions, most likely to occur Nov 1 - Apr 15)  
• Conservation | NOT SIGNIFICANT  
• Sites of high importance that will be avoided by the pipeline |
|     | Site affected: ‘Toumpa of Perni’ CH-11a-E                                     |                                                                                                      |                                       |
| 172 | Degradation of or damage to archaeological site intersecting the minimum working strip |                                                                                                      |                                       |
|     | Site affected: ‘Pondolivado’ CH-10a-E                                        |                                                                                                      |                                       |
| 176 | Degradation of or damage to archaeological site intersecting the minimum working strip |                                                                                                      |                                       |
|     | Site affected: ‘Nea Komi’CH-13a-E                                            |                                                                                                      |                                       |
| 178 | Degradation of or damage to archaeological site intersecting the pipeline trench and centreline due to pollution and vibration |                                                                                                      | MINOR  
• Site of high importance  
• With mitigation, anticipated impacts will be minor, if any |
|     | Site affected: ‘Wall of Kavala’ CH-4LK-E                                     |                                                                                                      |                                       |
| 178 | Degradation of or damage to archaeological site outside the regular working strip due to pollution and vibration |                                                                                                      | NOT SIGNIFICANT  
• Site of very high importance outside the area of influence  
• With mitigation, anticipated impacts will be not significant |
<p>|     | Site affected: ‘Akontisma of Nea Karvali’ CH-14-E                            |                                                                                                      |                                       |
| 240 | Degradation of or damage to archaeological site intersecting the minimum working strip due to pollution and vibration |                                                                                                      |                                       |
|     | Site affected: ‘Athanato Nero’ CH-19LS-E                                     |                                                                                                      |                                       |</p>
<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>244</td>
<td>Degradation of or damage to archaeological site intersecting the pipeline, reduced working strip, the pipeline trench and possibly the centreline due to pollution and vibration.</td>
<td>• Evaluation &lt;br&gt; • Avoidance &lt;br&gt; • Record of structure conditions and monitoring &lt;br&gt; • Structural reinforcement? &lt;br&gt; • Vibration-minimizing techniques &lt;br&gt; • Conservation</td>
<td>NOT SIGNIFICANT &lt;br&gt; • Site of high importance. &lt;br&gt; • The pipeline bundles with existing pipeline and passes through the outskirts of the designated area. &lt;br&gt; • With mitigation, anticipated impacts will not be significant.</td>
</tr>
<tr>
<td></td>
<td>Site affected: ‘Hill of Toumpa’ CH-23LS-E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>432</td>
<td>Degradation of or damage to sites with ICH value within 50 m of logistic roads due to pollution and vibration</td>
<td>• Evaluation &lt;br&gt; • Avoidance &lt;br&gt; • Record of structure conditions and monitoring &lt;br&gt; • Structural reinforcement &lt;br&gt; • Vibration-minimizing techniques &lt;br&gt; • Conservation</td>
<td>MINOR &lt;br&gt; • Site is of high importance and lies in proximity to heavy vehicle traffic &lt;br&gt; • With mitigation, anticipated impacts will be minor, if any</td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>446</td>
<td>Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration</td>
<td>• Evaluation &lt;br&gt; • Avoidance &lt;br&gt; • Record of structure conditions and monitoring &lt;br&gt; • Structural reinforcement &lt;br&gt; • Vibration-minimizing techniques &lt;br&gt; • Conservation</td>
<td>MINOR &lt;br&gt; • Site is of high importance and lies in proximity to heavy vehicle traffic &lt;br&gt; • With mitigation, anticipated impacts will be minor, if any</td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>450.2</td>
<td>Degradation of or damage to archaeological sites within 50 m of the centreline due to pollution and vibration</td>
<td>• Evaluation &lt;br&gt; • Avoidance &lt;br&gt; • Record of structure conditions and monitoring &lt;br&gt; • Structural reinforcement &lt;br&gt; • Low impact construction techniques &lt;br&gt; • Vibration-minimizing techniques &lt;br&gt; • Minimum Working Strip &lt;br&gt; • Protection &lt;br&gt; • Stop construction (wet conditions, most likely to occur Nov 1 - Apr 15) &lt;br&gt; • Conservation</td>
<td>MINOR &lt;br&gt; • Site is of high importance and lies in proximity to vibration and pollution-generating activities &lt;br&gt; • Blasting and hammering locations will affect impacts due to vibration &lt;br&gt; • With mitigation, anticipated impacts will be minor</td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-34774</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

74 This site, Omali Mikros, may not have above-ground features. Until site details are confirmed, the assessment must assume that the site includes structures, and thus may sustain impacts due to vibration.
<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| 455.4| Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration | - Evaluation  
- Avoidance  
- Record of structure conditions and monitoring  
- Structural reinforcement  
- Vibration-minimizing techniques  
- Conservation | MINOR  
- Site is of high importance and lies in proximity to heavy vehicle traffic  
- With mitigation, anticipated impacts will be minor |
|      | Site affected: CH-88                                                                                   |                                                                                                        |                                                                                                      |
| 475.1| Degradation of or damage to a site with ICH value within 50 m of the centreline and within 50 m of a logistic road due to pollution and vibration | - Evaluation  
- Avoidance  
- Record of structure conditions and monitoring  
- Structural reinforcement  
- Low impact construction techniques  
- Vibration-minimizing techniques  
- Minimum Working Strip  
- Protection  
- Stop construction (wet conditions, most likely to occur Nov 1 - Apr 15)  
- Conservation | MINOR  
- Site is of high importance and lies in proximity to vibration and pollution-generating activities  
- Blasting and hammering locations will affect impacts due to vibration  
- With mitigation, anticipated impacts will be minor |
|      | Site affected: CH-115                                                                                  |                                                                                                        |                                                                                                      |
| 484.2| Degradation of or damage to sites with ICH value within 50 m of logistic roads due to pollution and vibration | - Evaluation  
- Avoidance  
- Record of structure conditions and monitoring  
- Structural reinforcement?  
- Vibration-minimizing techniques  
- Conservation | MINOR  
- Site is of high importance and lies in proximity to heavy vehicle traffic  
- With mitigation, anticipated impacts will be minor, if any |
|      | Site affected: CH-121                                                                                  |                                                                                                        |                                                                                                      |
| 486.6| Degradation of or damage to sites with ICH value within 50 m of logistic roads due to pollution and vibration | - Evaluation  
- Avoidance  
- Record of structure conditions and monitoring  
- Structural reinforcement  
- Vibration-minimizing techniques  
- Conservation | MINOR  
- Site is of high importance and lie in proximity to heavy vehicle traffic  
- With mitigation, anticipated impacts will be minor, if any |
|      | Site affected: CH-125                                                                                  |                                                                                                        |                                                                                                      |
| 491.7| Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration | - Evaluation  
- Avoidance  
- Record of structure conditions and monitoring  
- Structural reinforcement  
- Vibration-minimizing techniques  
- Conservation | MINOR  
- Site is of high importance and lie in proximity to heavy vehicle traffic  
- With mitigation, anticipated impacts will be minor, if any |
<p>|      | Site affected: CH-130                                                                                  |                                                                                                        |                                                                                                      |</p>
<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>492.5</td>
<td>Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-215</td>
<td></td>
<td></td>
</tr>
<tr>
<td>492.7</td>
<td>Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-213</td>
<td></td>
<td></td>
</tr>
<tr>
<td>493</td>
<td>Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-212</td>
<td></td>
<td></td>
</tr>
<tr>
<td>493.1</td>
<td>Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-214</td>
<td></td>
<td></td>
</tr>
<tr>
<td>508</td>
<td>Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sites affected: CH-137</td>
<td></td>
<td></td>
</tr>
<tr>
<td>512.7</td>
<td>Degradation of or damage to sites with ICH value within 50 m of logistic roads due to pollution and vibration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-162</td>
<td></td>
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</tr>
</tbody>
</table>

**Disruption of user access to resource**

<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| 41-42 | Disruption of user access to an ICH site within 50 m from the centreline | • Evaluation  
• Avoidance  
• Community and local authorities(ephorates) | MODERATE  
• Site is of low importance intersecting the compressor station  
• with mitigation anticipated impacts will be moderate |
| | Site affected: CH-336-E | | |
### KP | Impact / Risk | Measures to Address the Impact / Risk | Significance of Residual Impact / Risk
--- | --- | --- | ---
42 | Disruption of user access to an archaeological site within 50 m from regular working strip possibly extending to the BVS02 and minimum working strip or centreline | - consultation  
- Planning to avoid user access restrictions  
- Alternate access  
- Public notification  
- Community liaison team to manage access | NOT SIGNIFICANT  
- Site is of low importance within 50 m from regular working strip possibly extending to the BVS02 and minimum working strip or centreline  
- With mitigation anticipated impacts will be not significant |
44-45 | Disruption of user access to an ICH site within 50 m from regular working strip | Site affected: CH-376-E |
46-47 | Disruption of user access to an ICH site intersecting the minimum working strip, the pipeline trench and possibly the centreline. | Site affected: CH-370-E |
56-57 | Disruption of user access to an ICH, AHAP site intersecting the minimum working strip, the pipeline trench and possibly the pipeline trench or centreline. | Site affected: CH 334-E |
58-59 | Disruption of user access to an ICH within 50 m from the regular working strip | Site affected: CH-333-E |
83-84 | Disruption of user access to an archaeological site at the edge of the pipeline working strip | Site affected: CH-354-E |
83-84 | Disruption of user access to an archaeological site within 50 m from regular working strip possibly extending to the regular working strip | Site affected: CH-353-E |
### Project Title:
Trans Adriatic Pipeline – TAP

### Document Title:
Integrated ESIA Greece

#### Section 8 - Assessment of Impacts and Mitigation Measures

<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| 123 | Disruption of user access to an archaeological site intersecting with the pipeline | Site affected: 'Justinian Walls and Aqueduct' CH-36-E | NOT SIGNIFICANT  
- Site is of high importance, crossed by the pipeline  
- Blockage of site access is anticipated to occur at construction fronts along the pipeline, for limited time |
| 154 | Disruption of user access to an archaeological site intersecting with the regular working strip | Site affected: 'Paradeisos – Kilisi Tepe' CH-12a-E | NOT SIGNIFICANT  
- Site is of high importance, crossed by the pipeline  
- Blockage of site access is anticipated to occur at construction fronts along the pipeline  
- With mitigation, restrictions will be not significant |
| 168 | Disruption of user access to archaeological sites intersected by the pipeline | Site affected: 'Toumpa of Perni' CH-11a-E | NOT SIGNIFICANT  
- Site of high importance avoided by the pipeline |
| 172 | Disruption of user access to archaeological sites intersected by the minimum working strip | Site affected: 'Pondolivado' CH-10a-E |
| 176 | Disruption of user access to archaeological sites intersected by the minimum working strip | Site affected: 'Nea Komi' CH-13a-E |
| 178 | Disruption of user access to an archaeological site intersecting with the pipeline | Site affected: 'Wall of Kavala' CH-4LK-E |
| 195 | Disruption of user access to archaeological sites within 50 m from the regular working strip | Site affected: 'Archaeological Area of Filipoi' CH-73LK-E |

**MINOR**
- Site of high importance  
- With mitigation, anticipated impacts will be minor, if any

**NOT SIGNIFICANT**
- Site of high importance avoided by local rerouting
### KP 455.4
**Impact / Risk:** Disruption of user access to a monument within 50 m of a logistic road

**Site affected:** CH-88

**Measures to Address the Impact / Risk:**
- Site is of high importance, located along logistic roads
- Blockage of site access is anticipated to occur at construction fronts along the pipeline
- With mitigation, restrictions will be minor

**Significance of Residual Impact / Risk:** MINOR

### KP 475.1
**Impact / Risk:** Disruption of user access to a site with ICH value within 50 m of the centreline and within 50 m of a logistic road

**Site affected:** CH-115

**Measures to Address the Impact / Risk:**
- Site is of high importance, located at the edge of the Regular Working Strip and/or along logistic roads
- Blockage of site access is anticipated to occur at construction fronts along the pipeline
- With mitigation, restrictions will be minor

**Significance of Residual Impact / Risk:** MINOR

### Negative effects on the setting and ambience of a resource

#### KP 41-42
**Impact / Risk:** Negative effects on the setting and ambience of a site with ICH value within 50 m of regular working strip

**Site affected:** CH-336-E

**Measures to Address the Impact / Risk:**
- Evaluation
- Avoidance
- Community consultation
- Stop construction near site on times/days TBD through community consultation

**Significance of Residual Impact / Risk:** MINOR

#### KP 42
**Impact / Risk:** Negative effects on the setting and ambience of an archaeological site within 50 m from regular working strip possibly extending to the BVS02 and minimum working strip or centreline

**Site affected:** CH-376-E

**Measures to Address the Impact / Risk:**
- Noise and vibration monitoring
- Guidance in Code of Conduct
- Aesthetic mitigation and noise screening techniques

**Significance of Residual Impact / Risk:** NOT SIGNIFICANT

#### KP 44-45
**Impact / Risk:** Negative effects on the setting and ambience of ICH sites within 50 m from regular working strip

**Site affected:** CH-370-E

#### KP 46-47
**Impact / Risk:** Negative effects on the setting and ambience of ICH sites within 50 m from regular working strip

**Site affected:** CH-339-E
46-47 Negative effects on the setting and ambience an ICH site intersecting minimum working strip, the pipeline trench and possibly the centreline.

Site affected: CH-394-E

56-57 Negative effects on the setting and ambience an ICH, AHAP site intersecting minimum working strip, the pipeline trench and possibly the pipeline trench or centreline.

Site affected: CH-334-E

58-59 Negative effects on the setting and ambience of a site with ICH value within 50 m of regular working strip

Site affected: CH-333-E

83-84 Negative effects on the setting and ambience of an archaeological site at the edge of the pipeline working strip

Site affected: CH-353-E, CH-354-E

123 Negative effects on the setting and ambience of an archaeological site intersecting with the pipeline

Site affected: 'Justinian Walls and Aqueduct' CH-36-E
### Integrated ESIA Greece

**Project Title:** Trans Adriatic Pipeline – TAP  
**Document Title:** Section 8 - Assessment of Impacts and Mitigation Measures

<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>154</td>
<td>Negative effects on the setting and ambience of an archaeological intersecting with the regular working strip</td>
<td>Site affected: 'Paradeisos – Kilisi Tepe' CH-12a-E</td>
<td></td>
</tr>
<tr>
<td>168</td>
<td>Negative effects on the setting and ambience of an archaeological sites intersected by the pipeline</td>
<td>Site affected: 'Toumpa of Perni' CH-11a-E</td>
<td></td>
</tr>
</tbody>
</table>
| 172| Negative effects on the setting and ambience of archaeological sites intersected by the minimum working strip | [Pipeline KP 172  
Site affected: 'Pondolvado' CH-10a-E] |                                           |
| 176| Negative effects on the setting and ambience of archaeological sites intersected by the minimum working strip | Site affected: 'Nea Komi' CH-13a-E |                                           |
| 178| Negative effects on the setting and ambience of an archaeological site intersecting with the pipeline | Site affected: 'Wall of Kavala' CH-4LK-E |                                           |
| 195| Negative effects on the setting and ambience of an archaeological sites within 50 m from the regular working strip | Site affected:  
'Archaeological Area of Filippoi' CH-73LK-E |                                           |
## KP Impact / Risk

### Measures to Address the Impact / Risk

### Significance of Residual Impact / Risk

<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
<th>Details</th>
</tr>
</thead>
</table>
| 432 | Negative effects on the setting and ambience of sites with ICH value within 50 m of logistic roads | Site affected: CH-79                                                                                 | MINOR                                  | • Site is of high importance, located within approximately 50 m of logistic roads  
• With mitigation, negative effects on the setting and ambience of these sites will be minor and temporary |
| 437 | Negative effects on the setting and ambience of sites with ICH value within 50 m of logistic roads | Site affected: CH-80                                                                                 | MINOR                                  | • Site is of high importance, located within approximately 50 m of logistic roads  
• With mitigation, negative effects on the setting and ambience of these sites will be minor and temporary |
| 455.4 | Negative effects on the setting and ambience of monuments within approximately 50 m of logistic roads | Site affected: CH-88                                                                                 | MINOR                                  | • Site is of high importance, located at the edge of the Regular Working Strip and along a logistic road  
• With mitigation, negative effects on the setting and ambience of the church will be minor and temporary |
| 475.1 | Negative effects on the setting and ambience of a site with ICH value within 50 m of the centreline and within 50 m of a logistic road | Site affected: CH-115                                                                                | MINOR                                  | • Site is of high importance, located within approximately 50 m of logistic roads  
• With mitigation, negative effects on the setting and ambience of these sites will be minor and temporary |
| 484.2 | Negative effects on the setting and ambience of sites with ICH value within 50 m of logistic roads | Site affected: CH-121                                                                                | MINOR                                  | • Site is of high importance, located within approximately 50 m of logistic roads  
• With mitigation, negative effects on the setting and ambience of these sites will be minor and temporary |
| 486.6 | Negative effects on the setting and ambience of sites with ICH value within 50 m of logistic roads | Site affected: CH-125                                                                                | MINOR                                  | • Site is of high importance, located within approximately 50 m of logistic roads  
• With mitigation, negative effects on the setting and ambience of these sites will be minor and temporary |
| 491.7 | Negative effects on the setting and ambience of monuments within approximately 50 m of logistic roads | Site affected: CH-130                                                                                | MINOR                                  | • Site is of high importance, located within approximately 50 m of logistic roads  
• With mitigation, negative effects on the setting and ambience of these sites will be minor and temporary |
<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>492.5</td>
<td>Negative effects on the setting and ambience of monuments within approximately 50 m of logistic roads.</td>
<td>Site affected: CH-215</td>
<td></td>
</tr>
<tr>
<td>492.7</td>
<td>Negative effects on the setting and ambience of monuments within approximately 50 m of logistic roads.</td>
<td>Site affected: CH-213</td>
<td></td>
</tr>
<tr>
<td>493.1</td>
<td>Negative effects on the setting and ambience of monuments within approximately 50 m of logistic roads.</td>
<td>Sites affected: CH-214, CH 212</td>
<td></td>
</tr>
<tr>
<td>508</td>
<td>Negative effects on the setting and ambience of monuments within approximately 50 m of logistic roads.</td>
<td>Site affected: CH-137</td>
<td></td>
</tr>
<tr>
<td>512.7</td>
<td>Negative effects on the setting and ambience of sites with ICH value within 50 m of logistic roads.</td>
<td>Site affected: CH-162</td>
<td></td>
</tr>
</tbody>
</table>


8.17.3.7 Operation and Maintenance Phase

There are no anticipated residual impacts during the operation and maintenance phase of the Project. Direct physical disturbance or damage is no longer a potential impact during the operations phase, since routine maintenance is not expected to require ground-disturbing activities in previously undisturbed areas. There is a slight possibility that during maintenance works formerly undisturbed areas might be affected by limited excavation and unknown cultural heritage resource being revealed. In such case, the existing Cultural Heritage Management Plan
will address any potential issues. Blasting and hammering will no longer be causes of vibration. Vibration from heavy vehicle traffic will be very limited and is not expected to be of a high enough magnitude to cause significant impacts. Monitoring of above-ground cultural heritage resources will continue during operation, however, to ensure the preservation of at-risk sites within the study area. Since there are no known cultural heritage sites that receive visitors located near a permanent Project facility that will require routine maintenance, such as the blockvalve stations, impacts on user access and setting and ambience are not anticipated during the operations phase.

8.17.3.8 Decommissioning Phase

Impacts during decommissioning are difficult to predict since decommissioning of the pipeline will not take place for at least 50 years. By the time of decommissioning, cultural heritage baseline conditions in the study area may have changed due to reasons unrelated to the Project. Decommissioning techniques may also have changed by that time, although whatever approach is taken will be state-of-the-art at the time it occurs. The assessment of residual impacts is based on the cultural heritage sites currently known within the study area.

The predicted sources of residual impact are heavy vehicle traffic and demolition activities associated with Project facilities. Abandonment-in-place of the pipeline (leaving it in the ground) constitutes current international best practice. Assuming that this approach is the same at the time of decommissioning, impacts along the pipeline will be minimal. Direct physical disturbance or damage is not an expected impact, during this phase since decommissioning will take place only in areas previously impacted during construction. Blasting and hammering will no longer be causes of vibration. In addition, no cultural heritage sites with above-ground components were identified in proximity to Project components that will require decommissioning (i.e. compressor stations, block valve stations), so demolition activities will not produce vibration and dust impacts. However, the movement of vehicles, equipment, and personnel during decommissioning may produce minimal impacts along logistic roads in the form of dust and vibration.

Dust and vibration impacts are expected to occur at sites with standing features located along logistic roads, including: CH-250-E, CH-36-E, CH-10a-E, CH-13a-E, CH-4LK-E, CH-12a-E, CH-11a-E; CH-7-E, CH-19LS-E, chapels (CH-125, CH-162 & CH-213), churches (CH-88, CH-121, CH-79, CH-115, CH-215, CH-212, CH-137, & CH-214), the Monastery of Virgin Mary in...
Kleissoura (CH-130) and Kastro bridge (CH-83). The significance of impacts is expected to be lower than those during the construction phase due to a lower volume of traffic during decommissioning. Negative effects to user access are expected on sites CH-376-E, during the decommissioning phase with a lower impact in comparison to the other phases of the project. Insignificant impacts to site setting and ambience are anticipated to sites CH-10a-E, and CH-13a-E during decommissioning phase.

*Figure 8-43* to *Figure 8-45* illustrates the locations and significance of residual impacts anticipated as a result of decommissioning phase activities.

*Table 8-104* presents a summary of mitigation measures and anticipated residual impacts for the decommissioning phase.
Figure 8-43 Locations and Significance of Residual Pollution and Vibration Impacts –Cultural Heritage – Decommissioning East (a)

Source: ASPROFOS (2013)
Figure 8-44  Locations and Significance of Residual Pollution and Vibration Impacts –Cultural Heritage – Decommissioning East (b)

Source: APROFOS (2013)
Figure 8-45  Locations and Significance of Residual Pollution and Vibration Impacts –Cultural Heritage – Decommissioning West

Source: ERM (2012)
<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| 21-22 | Degradation of or damage to AS Site within 50 m. from access road due to pollution and vibration | • Avoidance  
• Evaluation  
• Record of structure conditions and monitoring  
• Structural reinforcement?  
• Low impact construction techniques  
• Vibration-minimizing techniques  
• Minimum Working Strip  
• Protection  
• Stop construction (wet conditions, most likely to occur Nov 1- Apr 15)  
• Conservation | NOT SIGNIFICANT  
• Sites are of high importance within 50 m. from centreline  
• With mitigation, anticipated impacts will be not significant |
| 123 | Degradation of or damage to archaeological site intersecting the pipeline due to pollution and vibration | • Evaluation  
• Avoidance  
• Record of structure conditions and monitoring  
• Structural reinforcement?  
• Vibration-minimizing techniques  
• Conservation  
• Special crossing method | MINOR  
• Site of high importance and intersects the Project footprint  
• Minimization of impacts using special techniques, as will be determined at the time of decommissioning. |
| 154 | Degradation of or damage to archaeological site intersecting with the regular working strip due to pollution and vibration | • Avoidance  
• Evaluation  
• Record of structure conditions and monitoring  
• Structural reinforcement?  
• Low impact construction techniques  
• Vibration-minimizing techniques | NOT SIGNIFICANT  
• Site is of high importance and lie in close proximity to vibration and pollution-generating activities  
• Minimization of impacts using special techniques, as will be determined at the time of decommissioning. |
| 168 | Degradation of or damage to archaeological site outside the regular working strip due to pollution and vibration | • Minimum Working Strip  
• Protection  
• Stop construction (wet conditions, most likely to occur Nov 1- Apr 15)  
• Conservation | NOT SIGNIFICANT  
• Site of high importance avoided by the pipeline |
<table>
<thead>
<tr>
<th>KP</th>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>178</td>
<td>Degradation of or damage to archaeological site intersecting the pipeline trench and centreline due to pollution and vibration</td>
<td></td>
<td>MINOR</td>
</tr>
<tr>
<td></td>
<td>Site affected: ‘Wall of Kavala’ CH-4LK-E</td>
<td></td>
<td>- Site of high importance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- With the implementation of the mitigation measures impacts will be minimum, if any.</td>
</tr>
<tr>
<td>240</td>
<td>Degradation of or damage to archaeological site intersecting the minimum working strip due to pollution and vibration</td>
<td></td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td></td>
<td>Site affected: ‘Athanato Nero’ CH-19LS-E</td>
<td></td>
<td>- Site of high importance avoided by the pipeline.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- With mitigation, physical impacts will be not significant.</td>
</tr>
<tr>
<td>432</td>
<td>Degradation of or damage to Site with ICH value within 50 m of logistic roads due to pollution and vibration</td>
<td>• Evaluation</td>
<td>NOT SIGNIFICANT</td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-79</td>
<td>• Avoidance</td>
<td>- Sites are of high importance and are located in proximity to heavy vehicle traffic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Record of structure conditions and monitoring</td>
<td>- With mitigation, anticipated impacts will be not significant.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Structural reinforcement</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Vibration-minimizing techniques</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Conservation</td>
<td></td>
</tr>
<tr>
<td>446</td>
<td>Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>455.4</td>
<td>Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>475.1</td>
<td>Degradation of or damage to Site with ICH value within 50 m of logistic roads due to pollution and vibration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site affected: CH-115</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KP</td>
<td>Impact / Risk</td>
<td>Measures to Address the Impact / Risk</td>
<td>Significance of Residual Impact / Risk</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------------------------------------------------</td>
<td>---------------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>484.2</td>
<td>Degradation of or damage to Site with ICH value within 50 m of logistic roads due to pollution and vibration</td>
<td>Site affected: CH-121</td>
<td></td>
</tr>
<tr>
<td>486.6</td>
<td>Degradation of or damage to Site with ICH value within 50 m of logistic roads due to pollution and vibration</td>
<td>Site affected: CH-125</td>
<td></td>
</tr>
<tr>
<td>491.7</td>
<td>Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration</td>
<td>Site affected: CH-130</td>
<td></td>
</tr>
<tr>
<td>492.5</td>
<td>Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration</td>
<td>Site affected: CH-215</td>
<td></td>
</tr>
<tr>
<td>492.7</td>
<td>Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration</td>
<td>Site affected: CH-213</td>
<td></td>
</tr>
<tr>
<td>493</td>
<td>Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration</td>
<td>Site affected: CH-212</td>
<td></td>
</tr>
<tr>
<td>493.1</td>
<td>Degradation of or damage to monuments with ICH value within approximately 50 m of logistic roads due to pollution and vibration</td>
<td>Site affected: CH-214</td>
<td></td>
</tr>
</tbody>
</table>
### 8.17.4 Summary of Impacts on Cultural Heritage

Routing of the pipeline and the siting of the Compressor Stations (GCS00 and GCS01), BVSs and other Project components has avoided known cultural heritage to the extent possible. Any sites not already avoided, will be avoided through local re-routings, special crossing methods or
relocation. However, a number of cultural heritage resources are located in the vicinity of the Project footprint. In addition to the sites identified within the Project footprint, some identified archaeological sites may extend into the Project footprint and could produce archaeological finds during ground-disturbing activities. Based on the Project footprint, at least 37 known archaeological sites will be physically impacted to some degree. The following are highlighted: (i) The Justinian Walls and Aqueduct, (ii) the Wall of Kavala, (iii) the Archaeological Area of Filippoi, (iv) the Hill of Toumpa, in Nea Zichni, (v) Part of an aqueduct system near Amfitriti and (vi) the Korissos finds. The sites intersecting the Project footprint, as well as the site of Omali Mikros, identified by the 30th Ephorate, will be investigated further through subsurface testing prior to construction. Depending on the precise importance of the finds, which is not known yet, archaeological resources would be rescued in accordance with Greek law and international standards for the preservation of cultural heritage. TAP AG will also engage with stakeholders for monuments and sites with ICH value (i.e. Church of the Assumption) to understand and be able to address user access issues and to determine the days and times in which construction activities should be restricted (for example, popular visitation days, religious services, holidays, celebrations, etc.).

The Project will implement a Chance Finds Procedure that details the process to be followed in case an archaeological find is made during construction. The management of any finds will be handled in accordance with Greek national requirements and EBRD PR8 requirements. For built heritage, such as monuments or churches, that are located close to the working strip, work sites and logistics roads, and in particular where they are in the vicinity of sections where blasting and hammering will be employed for trenching, the need for temporary supports to protect structural integrity will be examined by conservation experts before construction and provided as necessary. The condition of the monuments, buildings and structures will be recorded by experts both before and after construction.

TAP AG will take all necessary precaution when conducting activities within vicinity of any built heritage sites along the pipeline route, however, if any Project-related damages to built-heritage should occur, TAP AG will arrange for repair by conservation experts in coordination with the authorities.
8.18 Non-Routine Events

8.18.1 Overview

The TAP system will transport natural gas which is a highly flammable substance. Due to the high levels of European and international safety standards and established state-of-the-art technology, transportation of natural gas can be considered a highly safe operation. Over the past decades incidents have been reduced to very low levels through continuous improvement of standards, and norms and practices for pipeline design and pipeline operation and maintenance. This is demonstrated by the following statistical data.

In Europe alone, the natural gas transmission network in 2006, had a length of over 220,000 km (source: Technical Association of the European Natural Gas Industry, 2006 Statistics). The European Gas Pipeline Incident Data Group (EGIG) collects data of about 135,000 km transmission pipelines every year (representing roughly 50% of gas transmission pipelines in Europe. EGIG is a co-operation between a group of fifteen major gas transmission system operators in Western Europe to gather data on the unintentional releases of gas in their pipeline transmission systems.

The 8th EGIG Report (2011) presents long term statistical pipeline incident data over the period 1970 – 2010 and analyses failure frequencies and main causes in six categories:

- External interference (i.e. third party ground works, digging, piling etc.);
- Corrosion;
- Construction defect / material failure;
- Hot tap made by error;
- Ground movement; and
- Other and unknown.

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75 http://www.marcogaz.org/index.php/statistics
76 http://www.egig.eu/
77 http://www.egig.eu/reports
78 The term “hot tap made by error” means that a tie-in connection to the transmission line was mistakenly attempted.
EGIG’s statistical database contains information about failure frequencies (including analysis by size of leak categories, i.e. pinhole/crack, hole, rupture) and the main causes of incidents, but not quantitative information on consequences.

The statistical analysis of EGIG inter alia shows that:

- The long term incident data (1970 - 2010) indicate a steady drop in incidents and have a trend to stabilise at very low level.
- External interference remains the main cause of incidents.
- Also external interference is the cause that results in bigger leaks, such as rupture (i.e. diameter of defect more than the pipeline diameter) and holes (diameter of defect more than 2 cm and equal to or less than the diameter of the pipeline), followed by ground movement as second cause\(^7\).

The EGIG database describes the relationship between external interference and pipeline diameter as well as the relation external interference and wall thickness. This is shown in **Figure 8-46** and **Figure 8-47**.

**Figure 8-46**  Relationship between External Interference and Pipeline Diameter (d)

[Diagram of Figure 8-46]


\(^7\)Definitions based on EGIG ([http://www.egig.eu/uploads/bestanden/3ad32044-252d-4aaa-b07e-6ffb727a5d03](http://www.egig.eu/uploads/bestanden/3ad32044-252d-4aaa-b07e-6ffb727a5d03))
The EGIG data shows, that the failure frequency is mostly related to small diameter pipeline systems with less wall thickness. The TAP system will have a diameter of 48" and an average wall thickness greater than 17 mm\(^{80}\). Comparing TAP’s technical design parameters with the EGIG statistic, the failure frequency is close to zero.

Accidental pollution of water resources resulting from accidental spills of liquid or solid wastes, fuels or hazardous chemical are described in Section 8.4.

TAP AG will implement the Project to established, European and international standards to provide safe operation of the system and minimise risks associated with the nature of natural gas transport\(^{81}\). TAP AG will also comply with the provisions of the Greek High Pressure Natural Gas Transmission System Technical Regulation. This regulation includes provisions, inter alia, for the preparation of a Safety & Risk Assessment Study. In addition to that a Fire Safety Study for the Compressor Stations will be elaborated in close collaboration with Greek Fire Brigades.

\(^{80}\)The wall thickness of the onshore pipe sections will vary depending on distance to, and density of, existing residential buildings within proximity to pipeline route.

\(^{81}\)Based on Seveso Directive (EU Directive 96/82/EG) compressor stations and pipelines for the transportation of natural gas are explicitly excluded from “Seveso” regulations.
During the development of the pipeline and its associated infrastructure, the Project has sought to avoid, and minimise risks from non-routine events through pipeline routing siting and through the technical design of the system and its components. This has considered Greek national requirements, European Union standards, best international industry practice and the requirements of EBRD’s PR3 (Pollution Prevention) and PR4 (Community Health Safety and Security) and relevant IFC EHS Guidelines. Through these appraisals and assessments, state-of-the-art measures have been identified and incorporated into the Project (see Section 4: Project Description).

Summarised from Section 4 – Project Description, key designed-in system safety features include:

- **The Design of the Pipeline**: will be according to the European standard EN1594. This proven standard specifies the common basic principles and functional requirements of gas supply systems operating over a maximum pressure of 16 bar.

- **Pipeline Safety Distance to settlements and population**: With regard to exposure of settled places to potential hazards from pipeline incidents, distance is a key mitigation factor. In particular, the route is avoiding settlements to the extent that is possible. The pipeline safety corridor will prevent individual residential houses and any other buildings being established closer than 20 m distance either side of the pipeline centreline; planned settlements will likely not be allowed to approach the pipeline closer than 200 m either side, depending on agreements with the Greek government.

- **Pipeline Integrity Protection**: In order to protect pipeline integrity, a number of measures are taken: The pipeline joints are tested in multiple steps (x-ray, ultrasonic, hydrotesting) and the pipeline is coated and buried in the ground with at least 1 m of coverage, the pipeline is fitted with cathodic protection to prevent corrosion, the pipeline protection strip (4 m to both sides of the centreline) does not allow any deep rooting permanent crops or plants to be planted within this strip, and finally regular pigging and inspection of the pipeline will be carried out. The entire pipeline system will be monitored and regularly inspected on site by walking, drive over or fly over to detect and, if occurring, stop third party activities, which are the main cause of pipeline incidents.

- **Pipeline Leak Detection**: The pipeline is monitored by a leak detection system, in the event of a pressure drop, the block valves will be closed to isolate the section where the leak has occurred. In addition there is surface inspection of the pipeline corridor. TAP AG will respond to any detected leaks through the implementation of its emergency response procedures, including emergency shut down, that will be set out in the Emergency
Response Plan (ERP). During the operations phase, the Leak Detection System and emergency shut down procedures will be key.

Box 8-20 shows the potential sources of impacts, potentially impacted receptors, and the baseline and project influencing factors associated to the impacts of the Project related to non-routine events.

### Box 8-20 Key Considerations for Assessment of Non-Routine Events

<table>
<thead>
<tr>
<th>Potentially Impacted Receptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Settlements and local population along the pipeline corridor;</td>
</tr>
<tr>
<td>- Land use and habitats;</td>
</tr>
<tr>
<td>- Ambient Air,</td>
</tr>
<tr>
<td>- Soil, Water Resources</td>
</tr>
</tbody>
</table>

**Particular Baseline Conditions that are Potentially Influencing Impacts**

- Proximity to populated areas.
- Proximity to sensitive environmental receptors (e.g. designated habitats).
- Proximity to water resources (surface and groundwater)

**Project Factors that are Potentially Influencing Impacts**

- Implementation of design standards (built in safety).
- Implementation of Spill Prevention and Control Plan
- Implementation of the ESMP including Waste Management Plan, Hazardous Materials Management Plan

**Source:** ERM (2012)

8.18.2 Potential Impacts

As previously reported, incidents for the 48” (onshore) pipeline are very unlikely to occur. The reported incidents within the EGIG database are mainly related to pipelines with smaller diameters and thinner walls rather than the pipe to be used for the Project.

However, during pipeline operation, potential impacts to human populations and the environment could occur from leakages due to, for example, external interference, corrosion or ground movement. Gas leakages have the potential to ignite and could lead to fatalities. The pipeline will therefore be built and operated with several safety features and the residual risk for any potential impact will be kept to a minimum. Safety features include the design being in according with
proven design standard EN 1594 and the Greek High Pressure Natural Gas Transmission System Technical Regulation, pipeline safety distances, pipeline integrity protection systems, and leak detection systems.

According to a preliminary evaluation, the individual risk for a person who is permanently present at the pipeline (24 hrs / 365 days a year) is of a frequency of $3 \times 10^{-6}$ per year or three times every 1,000,000\textsuperscript{82} years.

Accidental pollution of water resources (Sec 8.4) or soils (Sec 8.5) might potentially occur through spills of solid and liquid wastes produced, stored or disposed and through accidental spills of fuels, chemicals or hazardous materials and wastes stored or handled at the construction or camps sites for use or fuelling of construction machines and transportation vehicles. Relevant waste types are domestic waste (to be transported to a controlled municipal waste disposal site), oily and hazardous waste (to be segregated for collection and disposal by specialist contractors), and liquid waste or wastewater ("black" and "grey" water from construction and operation camps, rainwater from sealed surfaces and roofs, and tunnelling machines cooling water).

8.18.3 Mitigation Measures

The pipeline will be continuously monitored by a Leak Detection System (LDS) that monitors flow, pressure and temperature, thereby detecting losses on an automatic basis. Section 4.8.3.2 provides further details on the system incorporated into the pipeline. Undetected leaks are now a rare occurrence in modern gas pipelines as LDSs allow immediate notification and action in an emergency. TAP AG will respond to any detected leaks through the implementation of its emergency response procedures, including emergency shutdown, that will be set out in the Emergency Response Plan (ERP) – refer to Section 8.18.3.2. During the operations phase, the LDS and emergency shut down procedures will be key.

Measures to mitigate impacts related to accidental spills of wastes or chemicals are presented in more detail in Sections 8.4 and 8.5 with regard to Water Resources and Soil and Subsoil.

\textsuperscript{82}This frequency is considerably low when compared to other risks to the population. For example: the annual risk to die of cancer is about 1 in 387 years; and to die from a road accident (all forms) is about 1 in 16,800.
8.18.3.1 Detailed Risk Assessment to inform final Design

In the further course of planning, TAP AG will undertake a full Risk Assessment to confirm the high safety standards. The Risk Assessment study will comply with the provisions of the National Legislation. Depending on the outcomes of the detailed risk assessment additional measures to reduce the likelihood of pipeline failure may for instance include detailed centreline routing to achieve larger distances from residential houses and technical measures such as increasing of wall thickness in relevant sections in order to further reduce the pipeline's susceptibility to external threats. The design of the pipeline will be according to the European standard EN 1594 and the Greek High Pressure Natural Gas Transmission System Technical Regulation.

8.18.3.2 Emergency Response Plan

As outlined above, the Project includes built-in safety features according to established standards and norms. In order to address the handling of residual risk associated with non-routine events during operation, TAP AG will develop an ERP that will specify the actions required in case of an incident. The ERP will be developed according to Greek and EU requirements and international industry standards and best practice. The ERP will classify incidents in levels (e.g. Level 1, 2 and 3 incidents) and define criteria for action. The following classification is typically applied:

- **Level 1 Incident**: A leak that represents an existing or probable hazard to persons or property. Requires immediate repair or continuous action until the conditions are no longer hazardous. These incidents require application of the ERP, including actions such as notifying the police and fire departments, evacuating the area, blocking off the area, re-routing traffic, eliminating sources of ignition and stopping the flow of gas;

- **Level 2 Incident**: A leak that is recognized as being non-hazardous at the time of detection, but justifies scheduled repair based on probable future hazard. These incidents are to be monitored and repaired; and

- **Level 3 Incident**: A leak that is non-hazardous at the time of detection and can be reasonably expected to remain non-hazardous:

The ERP will be developed in consultation with the competent authorities, emergency services/civil defence and the municipality administrations along the pipeline route.
Based on consultations with relevant stakeholders, TAP AG will investigate the capacity of statutory local and regional emergency response providers to participate in emergency response activities. TAP AG will provide necessary training, engage in the organisation of drills and exercises, and if needed, TAP AG will also provide for necessary improvements to equipment e.g. of local fire brigades / civil defence units.

Households in communities in the vicinity will receive information via leaflets which will advise how to behave in case of a pipeline leak or incident.

An outline of a typical emergency response plan is provided in the ESMMP in Section 9.3.3.

### 8.18.3.3 Other Mitigation Measures

Large pipeline construction sites have the potential for uncontrolled site run-off and accidental spills of fuels, lubricants, waste and other water endangering substances. Such potential sources of impact can be largely avoided by site runoff management, wastewater treatment, waste management, proper handling and storage of water endangering substances, i.e. good housekeeping practice construction management by the EPC contractor. A Spill Contingency Plan to respond to any spill or unintentional discharge of untreated wastewater or waste to water or to soil will be set-up. Special caution to prevent silting or spills will be required near locations where the shallow aquifer is used for water supply or surface water is used for irrigation.

General mitigation measures will include:

- Implementation of the ESMMP and topical sub-plans according to international best practice;
- Development of a Waste Management Plan (see Section 9.3) to avoid solid or liquid waste discharges to water bodies; and
- Development of a Hazardous Materials Management Procedure (see Section 9.3) in order to detail procedures for working with chemical products.
- Develop a Spill Prevention and Response Plan (see Section 9.3) to avoid and react on any pollution of water bodies that may accidently occur.

Further specific mitigation measures are described in the corresponding chapters.
8.18.4 Residual Risk

A residual risk of non-routine events occurring is inherent to the nature of the Project type and will always remain. The Preliminary Risk Assessment report has established that considering the implementation of the foreseen risk minimisation measures as described above, the societal risk is within the range defined by TAP AG’s policy criteria, which is close to zero.

To confirm the final design, a more detailed Quantitative Risk Assessment and a Safety Study will be undertaken by TAP AG and additional risk reduction measures will be defined as needed.

All residual impacts associated to accidental spills of wastes, hazardous materials, fuels, etc. are evaluated in the corresponding chapters to present an impact significance not significant / minor.

8.19 Cumulative / Combined Impacts

8.19.1 Identification of Relevant Cumulative Impacts Sources

Prediction and evaluation of cumulative impacts is not straightforward as it is not always possible to directly combine different types of environmental impacts on an objective basis. Nevertheless, international ESIA best practice recognises that an impact that has cumulative effects is likely to be a more serious concern and should be highlighted.

Cumulative impacts may be broadly defined as impacts that result from the accumulation of a number of individual impacts (European Commission DG XI (1999) Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, OOPEC, May 1999, p iii and Section 2.1). They may result from various types of interaction, including:

- impacts which are the result of the combination of activities associated with the TAP Project together with other development projects (e.g. impacts caused by TAP construction may be exacerbated by construction activity from other major construction projects nearby);
- impacts that arise from the accumulation of different impacts at a specific location (e.g. construction noise and visual intrusion affecting the same receptor – individually these may
not be significant, but the accumulation of different impacts may give rise to an overall significant impact) and

- the accumulation of impacts of the same type at different locations (e.g. non-significant individual ecological impacts at different sites collectively may give rise to an overall significant ecological impact in a route-wide context) – these impacts were identified in the relevant thematic topic assessment earlier in this Section (e.g. Ecology in Section 8.8).

Cumulative impacts in the project region potentially occur from the combined effects of the TAP Project with other presently ongoing or reasonably foreseeable future activities in the study area. Such other projects have been identified based on a desk based study, and on information received throughout the Stakeholder Engagement (see Section 7) undertaken during Autumn 2011 and 2012 and the beginning of 2013 are summarised in Table 8-105. For some of these projects only very scarce information is available and therefore allowing only for a limited assessment of potential in-combination impacts.

Following the bundling approach with existing infrastructure, TAP will run in parallel alignment to an existing natural gas pipeline. The close distance (less than about 50 m) of the TAP pipeline to the existing pipeline in the section between Turkish border and Nea Mesimvria sums up to an overall length of approximately 230 km. The existing pipeline started operation for the section Nea Messivria – Komotini in 2000 and for the section Turkish border to Komotini in 2007.

There are only a few large third party projects, which combined with the TAP Project may result in cumulative effects on the environment. The developments identified which may potentially interact with the TAP Project and create cumulative effects on the environment have been selected primarily through knowledge of other major infrastructure projects planned for development. There are a number of projects that may occur at the same time as the TAP Project, and the consequence of the potential interactions is assessed in Section 8.19.2.

The future planned projects identified near to the pipeline route and that have the potential to interact with the TAP Project are described in Table 8-105.
**Table 8-105** Future Planned Projects considered for Cumulative Assessment

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Possibility of Interaction with TAP?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste treatment plant in the Municipality of Alexandroupoli</td>
<td>Yes</td>
</tr>
<tr>
<td>Waste treatment plant in the municipality of Alexandroupoli. A preliminary design is in place and currently is in the phase of selecting a contractor. (KP 42.6 – KP 43.5)</td>
<td></td>
</tr>
<tr>
<td>New irrigation pipeline (D600 / 25.8 km) at Alexandroupoli</td>
<td>No</td>
</tr>
<tr>
<td>New drain line in the Municipality of Alexandroupoli from Mesti to Alexandroupoli. (KP 65.9 - KP 72.1)</td>
<td></td>
</tr>
<tr>
<td>Biological wastewater treatment plant in the Municipality of Maronia - Sapes</td>
<td>Yes</td>
</tr>
<tr>
<td>Preliminary design of a biological treatment plant, 20 m distance from the existing national gas pipeline. Currently this project is in the phase of selecting a contractor. (KP 71.0 – KP 71.2)</td>
<td></td>
</tr>
<tr>
<td>Development of building facilities in Kosmio</td>
<td>No</td>
</tr>
<tr>
<td>Development of teaching and living building facilities for people with disabilities in Alonia, Kosmio. (KP 94.6 – KP 94.8)</td>
<td></td>
</tr>
<tr>
<td>Project</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>Hospital development in Scholi Astynomias</td>
<td>Hospital development close to the area of Scholi Astynomias. About 200 m distance from the existing national gas pipeline. Funding through NSRF (ESPA) programme. (KP 103.3 – KP 103.7)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Sewage network system in Gallini</td>
<td>Future Plans for sewage network system south of Gallini, starting from Dialampi to Koptero. (KP 120)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Management of Kosynthos River up to Vafeika</td>
<td>Currently the management of Kosynthos River, up to Vafeika, is in progress. Plans for future management study from Vafeika up to the end of river Kosynthos through NSRF (ESPA) funding programme. (KP 135)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of Egnatia connection roads between Drama - Kavala</td>
<td>The development of Egnatia connection roads between Drama – Kavala is currently under design. TAP pipeline crosses these roads. (unknown location)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of a new railway line in the Municipality of Kavala.</td>
<td>Plans for future construction of a new train line in the municipality of Kavala, from Nea Karvali to Toxotes. (KP 176.8)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Description</td>
<td>Possibility of Interaction with TAP?</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Development of new power transmission line (400 kV) ‘Thessaloniki – Bulgaria’.</td>
<td>Yes</td>
</tr>
<tr>
<td>Development of new power transmission line (400 kV) ‘Lagada – Filipon’.</td>
<td>Yes</td>
</tr>
<tr>
<td>Development of a new connection road between Thessaloniki - Kilkis</td>
<td>No</td>
</tr>
<tr>
<td>Development of sewage network to the wastewater treatment of Nea Zichni</td>
<td>Yes</td>
</tr>
<tr>
<td>Reinstatement of 9 Landfills in the municipalities of Nea Zichni, Amfipoli and Visaltia of Regional Entity of Serres</td>
<td>No</td>
</tr>
<tr>
<td>Project Description</td>
<td>Possibility of Interaction with TAP?</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Development of Interconnector Greece – Bulgaria High Pressure Natural Gas Pipeline (IGB)</td>
<td>No</td>
</tr>
<tr>
<td>Aghialos Urban Development</td>
<td>No</td>
</tr>
<tr>
<td>Irrigation system development in N. Messimvria</td>
<td>No</td>
</tr>
<tr>
<td>N. Messimvria Urban Development, Chalkidona Municipality</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Gefura Urban Development

**Description:**
The approved General Urban Plan shows the settlement of Gefura expanding towards the north to a distance of approximately 180 m of the Project corridor.

(KP 367– KP 368)

- **Possibility of Interaction with TAP?:** No
- The residential development of the area is likely to be gradual over a period of several years. It is likely that the Project will have completed construction before this development commences. It is unlikely that construction phase of this development and the Project will overlap.

No interactions with the Project are therefore likely to occur and no further assessment has been made.

### Drainage/anti-flood work

**Valtochorio**

- **Description:**
  There are proposals for drainage improvements and flood alleviation works in response to winter flooding events. No works have yet been approved and the community is currently seeking funding from the Municipality.

(KP 373-375)

- **Possibility of Interaction with TAP?:** No
- Given the lack of available information to confirm the likely progress of this development, it is considered unlikely that this project will overlap with the construction phase of the Project.

No interactions with the Project are therefore likely to occur and no further assessment has been made.

### Road connection of Skydra-Naousa-Patris-Egnatia Highway

- **Description:**
  This projects aims to build a new connection between Skydra-Naousa-Patris-Egnatia Highway.

  The part between Naousa-Patrida was expected to be finalised by 2012. The part between Naousa-Sevastiana is still in the study phase.

  No further information is available regarding the timetable for the development of this project.

- **Possibility of Interaction with TAP?:** No
- Given the information available, it is likely that the Project will have completed construction before this development commences. It is unlikely that construction phase of this development and the Project will overlap.

No interactions with the Project are therefore likely to occur and no further assessment has been made.

### Industrial area of Petrea

- **Description:**
  The industrial area has been designated since 1985 but since then no progress has been made. There are no operational facilities yet located within the industrial area.

  No further information is available regarding the timetable for the development of the industrial area.

- **Possibility of Interaction with TAP?:** No
- Given the lack of available information to confirm the likely progress of this development, it is considered unlikely that this project will overlap with the construction phase of the Project.

No interactions with the Project are therefore likely to occur and no further assessment has been made.

### Photovoltaic stations in Industrial area of Petrea

- **Description:**
  Two photovoltaic stations are to be installed in the Industrial area of Petrea. There are two electricity generation licenses, each for 4480kW.

  No further information is available regarding the timetable for the development of this project.

- **Possibility of Interaction with TAP?:** No
- Given the lack of available information to confirm the likely progress of this development, it is considered unlikely that this project will overlap with the construction phase of the Project.

No interactions with the Project are therefore likely to occur and no further assessment has been made.
### Project Title:
**Trans Adriatic Pipeline – TAP**

### Document Title:
**Integrated ESIA Greece**

**Section 8 - Assessment of Impacts and Mitigation Measures**

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Possibility of Interaction with TAP?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Photovoltaic Solar Panels in Maniaki</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Energiaki S.A Wind Farm MW16</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Integrated Programme for the sustainability of Vermio mountain</strong></td>
<td>No</td>
</tr>
</tbody>
</table>

Communities in the broader area however have expectations for eco-tourism development.
### Project Title:
Trans Adriatic Pipeline – TAP

### Integrated ESIA Greece
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<table>
<thead>
<tr>
<th>Project</th>
<th>Description</th>
<th>Possibility of Interaction with TAP?</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of road connection between Ano and Kato Grammatiko</td>
<td>It is an important development priority for the community to restore the road connection between Ano Grammatiko and Kato Grammatiko. The project has not secured approval from the Municipality and funding is currently unavailable (2012). (KP 438-439)</td>
<td>No</td>
<td>Given the unavailability of funding and the absence of an approval, it is considered unlikely that this project will overlap with the construction phase of the Project. No interactions with the Project are therefore likely to occur and no further assessment has been made.</td>
</tr>
<tr>
<td>Ano Grammatiko Urban development</td>
<td>The approved General Urban Plan for the settlement of Ano Grammatiko shows expansion towards the south, away from the pipeline. The expansion will not affect the pipeline. No further information is available regarding the timetable for the development of this project. (KP 439 – KP 440)</td>
<td>No</td>
<td>The residential development of the area is likely to be gradual over a period of several years. It is likely that the Project will have completed construction before this development commences. It is unlikely that construction phase of this development and the Project will overlap. No interactions with the Project are therefore likely to occur and no further assessment has been made.</td>
</tr>
<tr>
<td>Development of sewer pipes to connect villages to the waste treatment plant in Ptolemaida</td>
<td>A project for the development of a sewerage network to connect many villages of Eordea municipality such as Droseron, Galateia, Perdikkas and Pentavrussos to the wastewater treatment plant in Ptolemaida has obtained an environmental permit. (KP 470-480)</td>
<td>Yes</td>
<td>There is no information regarding scale, timetable or availability of funding. However it is assumed that this funding application will be successful and the programme for this development and the Project will overlap. The potential for interactions with the Project therefore exists. An assessment of these potential interactions is described in Section 8.19.2.</td>
</tr>
<tr>
<td>Irrigation dam at Droseron</td>
<td>Plans for a dam 5 km away from the village. This will be used for an irrigation system. No further information is available regarding the timetable for the development of this project.</td>
<td>No</td>
<td>Given the geographical location and scale of this irrigation dam it is considered unlikely that interactions with the Project will occur. No interactions with the Project are therefore likely to occur and no further assessment has been made.</td>
</tr>
<tr>
<td>Kleisoura tunnel and road</td>
<td>Kleisoura tunnel and road has been approved and has been pending for several years, but funding was not available (2012). No further information is available regarding the timetable or the availability of funding for the development of this project.</td>
<td>No</td>
<td>Given the lack of available funding and the absence of an approval, it is considered unlikely that this project will overlap with the construction phase of the Project. No interactions with the Project are therefore likely to occur and no further assessment has been made.</td>
</tr>
<tr>
<td>Project Description</td>
<td>Possibility of Interaction with TAP?</td>
<td></td>
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<tr>
<td>-----------------------------------------------------------------------------------</td>
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<td></td>
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</tr>
<tr>
<td>Tsakoni Development of Wastewater Treatment System</td>
<td><strong>No</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of wastewater treatment system has been approved and was expected to start in spring of 2012.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Integrated Programmes for the Development of Agricultural Area Korissos</td>
<td><strong>No</strong></td>
<td></td>
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</tr>
<tr>
<td>Community has applied for funding from the Integrated Programme for the Development of Agricultural Areas (2012). No further information is available regarding the timetable for the development of this project.</td>
<td></td>
<td></td>
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<tr>
<td>Development of wastewater pipeline from Korissos</td>
<td><strong>No</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A wastewater pipeline project is currently under development and is scheduled for completion in 2013.</td>
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</tr>
<tr>
<td>Road connection Kleisoura</td>
<td><strong>No</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The road to connect Vlasti and Numfaio ran out of funding and remains partially built. No further information is available regarding the timetable or the availability of funding to complete this project.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Industrial zone development Dispilio</td>
<td><strong>No</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial zone development in the area of Argos Orestiko and Maniaki, north of the pipeline route. Approval for development within the zone has been obtained, but no progress has been made. There are no operational facilities yet located within the industrial area. No further information is available regarding the timetable for the development of the industrial area.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban expansion plan Dispilio</td>
<td><strong>No</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plans for the expansion of the housing zone were to be approved by Kastoria Urban Planning Authority (2012). The housing zone lies outside the pipeline corridor.</td>
<td></td>
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</tr>
</tbody>
</table>
Nestorio irrigation dam, Nestorio Municipality

The project is considered among the largest development projects in Western Macedonia, planned to finish construction by about 2014. After the dam is constructed, the pipe network to distribute water to the fields will be installed, which will provide the opportunity to shift agricultural production to dynamic cultivations. The pipe network is not yet defined.

The Project passes the villages of Chiliodentro and Poreia between KP 523 and KP 525.

Project implementation suffers from significant delays as construction works have stopped for some time. Recent communication (May 2013) suggests that construction is likely to start again and continue throughout 2014 and 2015.

Yes

Given the geographical location and the programme for construction, the potential for interactions with the Project exists. An assessment of these potential interactions is described in Section 8.19.2.

Oinoi Irrigation dam

There are proposals to improve the irrigation to agricultural areas, but no funding was available (2012).

No

Given the unavailability of funding and the absence of an approval, it is considered unlikely that this project will overlap with the construction phase of the Project. No interactions with the Project are therefore likely to occur and no further assessment has been made.

Wind Farm of ADEMCO (Aiol Dytikas Makedonias)

Windfarms with a total capacity of 163 MW located in the Triklarion Mountains in Kastoria and Nestorio municipality have secured a generation license. At approximately KP 538 and KP 540 the pipeline narrows to about ~100 m distance of a number of proposed wind turbines in the preliminary layout.

No further information is available regarding the timetable or availability of funding for the development of these projects. As of May 2013 no construction has been started.

Yes

Given the geographical location the potential for interactions with the Project exists should the construction programmes overlap. An assessment of these potential interactions is therefore described in Section 8.19.2.

8.19.2 Potential Cumulative Impacts

From the evaluation of the projects described in Table 8-105 eleven projects have a delivery timetable with the potential to coincide temporally with the TAP Project’s construction phase. Overlapping operation phases do present potential for cumulative impacts due to the small
workforce of the Project and nature of the activities during operation (e.g. maintenance and control).

The environmental impacts due to the TAP Project as described in the Section 8.2 to 8.17 are related mainly to the construction phase, while regular operation results in impacts of minor significance.

The Project envisages starting construction in early 2015 and will be carried out over a period of approximately 3 years (commissioning expected during 2018).

The transient nature of pipeline construction will however mean that the main pipeline construction sections (spreads) described in Figure 4-12 (Section 4.4.3.1) will be constructed over periods of between 4 to 14 months depending mainly on constructability. All route sections are planned to be finished by autumn 2017 followed by the finalization of reinstatement works and the pre-commissioning by end of 2017.

Construction activities of different work fronts from top soil removal until trench backfill and reinstatement will happen in consecutive steps (see Section 4) resulting in construction periods of about 3 - 4 months for a defined part of the pipeline (local extensions < 5 km).

Prior to construction commencement, the preparation of the construction camps and the pipeyards will require four (4) and two (2) weeks for setting-up, respectively. Due to the nature of the progressing pipeline construction site, there will be only a few fixed locations where construction will last for more than a few months. These are the construction sites for the compressor station, where construction will take up to 24 months, as well as pipeyards and camp sites areas (approx. 9 to 14 months periods of activities). This starts with about 5 months of pipes deliveries to pipeyards and subsequent excavation, pipe laying and backfilling.

Other investment proposals not materialised at the moment of this assessment (funding or detailed construction schedules not confirmed), or either located at some distance from the TAP Project are not considered in this assessment.

A summary of how these projects may interact with the TAP Project is presented in Table 8-106.
<table>
<thead>
<tr>
<th>Project</th>
<th>Potential Interaction with TAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste treatment plant in the Municipality of Alexandroupoli (KP 42.6 – 43.5)</td>
<td>The interaction of the construction of the waste treatment plant with the project will be limited in duration of the construction of one pipeline section KP 42 – 65 (tbc: about 6 months) and the installation of Camp 1 (KP 40, approx. 2 km distance) and GPY 2 (KP 41). The waste project has an estimated surface of about 48 ha, of those about 30% is cultivated land. It is partly located within garriques of eastern Mediterranean habitat. Conversion of current agricultural land and subsequent effects on livelihoods by this project are estimated to be low given the assumed size of about 15 ha crop land. This area of development is considered to have widespread habitats of the region. Noise and dust emissions would likely combine given the small distance between both projects. However construction timelines will only overlap for about 7 months and nearest settlement of Amfitriti is more than 2 km away. Potential Workforce issues due to Projects camp site and this development will likely have minor impacts to near settlements, due to the assumed small workforce number for the construction of the waste facility. Main interaction between these two projects is likely to be the traffic generated by the movement of construction materials and personnel to the work sites.</td>
</tr>
<tr>
<td>Biological wastewater treatment plant in Maronia-Sapes Municipality (KP 71.0-71.2)</td>
<td>The interaction of the construction of the biological wastewater treatment plant with the project will be limited to the duration of the construction of the pipeline section KP 65 – 140 (about 12 months) including the construction of GPY 3 (KP 70, distance about 1 km). The wastewater project has an estimated surface of about 3 ha, mainly forested land. It is located within Mediterranean subnitrophilus grasslands and south-eastern-Mediterranean deciduous thickets (Quercus) habitats. This area of development is considered to have habitats with moderate value. These habitats are common for the region and combined effects are likely to be minor. Disturbance fauna is also considered minor. Noise and dust emissions from constructions sites will likely combine to higher audible levels or dust settlements given the construction sites of both project being adjacent. Nevertheless no nearby sensitive receptors (more than 2 km distance) have been identified. Traffic on local access roads to both construction sites might overlap, although no nearby receptors are likely to be impacted. Traffic increase on the main road next to the GPY3 is considered non significant.</td>
</tr>
<tr>
<td>Hospital development in Scholi Astynomias (Kp 103.3 – 103.7)</td>
<td>The interaction of the construction of the pipeline section KP 65 – 140 of about 12 months. Projects GPY4 (KP 101) and Camp 2 (KP 97) are located in a radius of less than 5 km. The development of the hospital will require a surface of approximately 9 ha, all the area was identified to be agricultural land. Noise and dust emissions from construction sites will likely combine to higher audible levels or dust settlements given the construction sites of both project being less than 500 m distant from each other. Nevertheless no nearby sensitive receptors have been identified (Meleti settlement about 1 km away). Potential Workforce issues due to Projects camp site and this development will likely have insignificant impacts to near settlements, since it is most likely that hospital workforce will be accommodated in Komotini or surrounding larger villages. Traffic on local access roads to both construction sites might overlap, although no nearby receptors are likely to be impacted. Traffic increase on the main road next to the camp site is considered non significant.</td>
</tr>
</tbody>
</table>
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Project

Development of a new railway in the Municipality of Kavala (KP 176.8)

Potential Interaction with TAP

The interaction of the construction of the new railway with the Project will overlap for a period of approximately 2 years during the construction of section KP 140 – 177. Camp 3 and GPY 6 (both at KP 184) will be located in a distance of about 8 km.

The railway project has a crossing with the basecase route at this point, which is located about 70 m from the limits of the Egnatia Highway. The surrounding area is mainly agricultural with some urban features.

The interaction between these two projects is likely to increase local traffic generated by the movement of construction materials and personnel to the work sites over TAP Project construction period.

This area of development is considered to have no sensitive habitats.

Pressure on mineral resources (aggregates, bedding materials) in the area of both projects is likely to be increased.

Potential workforce issues due to Projects camp site and this development will likely have minor impacts to near settlements given the way in which urban developments usually progress.

Noise emissions from construction sites will likely combine but given the short distance to the highway, audible levels will not be higher. Combined dust emissions will increase, but overall they will remain at the same level.

No residential buildings were identified.

Development of new power transmission line ‘Thessaloniki – Bulgaria’ (400 kV) at Lagada, in the area of Dorkadas – Karteres. (KP 325.4)

If the power transmission line construction schedule will overlap with the TAP programme in this area between KP 314 – 359. GPY 11 (KP 331) and Camp 5 (KP 332) will be located in a radius of 5 km.

The transmission line project has a crossing with the basecase route at this point. It is located within Mediterranean subnitrophilus grasslands and south-eastern-Mediterranean deciduous thickets habitats with a high degree of fragmentation.

In the wider area of this development there is presence of wolf populations and raptors. Disturbance to fauna is likely during construction time. Temporary fragmentation will not be combined since the transmission line project does not require construction roads along their alignment.

Effects of combined temporary land take are considered to be negligible, given the assumed size of the foundations for the transmission line towers.

Given no near settlements and no nearby residential housing cumulative landscape and visual amenity disturbance during construction of the two projects might be experienced by visitors of the Kroussia Mountain area and users of nearby main road. Disturbance during construction phase is considered minor. After the reinstatement of the working strip the pipeline will not be visible.
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<table>
<thead>
<tr>
<th>Project</th>
<th>Potential Interaction with TAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of new power transmission line ‘Lagada–Filipon’ (400 kV) at Paleochori (KP 210.8)</td>
<td>If the power transmission line construction schedule will overlap with the TAP programme in this route section between KP 192 – 224. GPY 7 (KP 219) will be located at a distance of about 6 km. The transmission line project has a crossing with the basecase route at this point. It is located within agricultural land without any particular habitats. Effects of combined temporary land take are considered to be negligible, given the assumed size of the foundations for the transmission line towers. Noise and dust emissions from constructions sites will likely not combine to higher audible levels or dust settlements given the distance to nearby sensitive receptors (more than 2 km distance). Traffic on local access roads to both construction sites might overlap, although no nearby receptors are likely to be impacted. Potential Workforce issues due to Projects camp site and this development will likely have insignificant impacts to near settlements, since it is most likely that transmission line workforce will accommodate in surrounding larger villages. The residents of nearby settlements will potentially experience cumulative landscape and visual amenity impacts during construction of the two projects. However, these are considered not significant due to the distance. After the reinstatement of the working strip the pipeline will not be visible.</td>
</tr>
<tr>
<td>Development of sewage network to the wastewater treatment of Nea Zichni (KP 243)</td>
<td>The interaction of the construction of the sewerage networks with the Project will be limited during the construction of the pipeline section between KP 224 – 294. GPY 8 and Camp 4 (both KP 254) will be located at a distance of more than 10 km. The wastewater treatment plant of Nea Zichni is located 550 m to the north of the basecase route. The crossing point of the connection sewer to this plant is unknown. The study area in which could be located is mainly agricultural land with some smaller spots of reforestation habitat. Noise and dust emissions from construction sites will likely not combine to higher audible levels or dust settlements, given the distance of more than 1 km to nearby sensitive receptors (Nea Zichni settlement). Pressure on mineral resources (aggregates, bedding materials) in the area of both projects is not likely to be increased significantly. Traffic on local access roads to both construction sites might overlap. Disturbance on nearby national road Serres to Drama (EO12) might occur. In addition, some existing local roads might be crossed by the sewage construction. Overall impacts on traffic are considered to be not significant/ minor.</td>
</tr>
<tr>
<td>Sewer network connection of villages to wastewater treatment plant of Ptolomaida, Eordea Municipality (KP 470 - 480)</td>
<td>The interaction of the construction of the sewerage network with the Project will be limited in duration to a period of approximate 9 - 12 months during the construction of the pipeline section between KP 446 - 484. As the details of the network construction are not currently known, interaction with GPY 15 (KP 480), 800 m north of Drosero, cannot be specified. Pressure on mineral resources (aggregates, bedding materials) in the area of both projects is likely to be increased. Noise and dust emissions from construction sites will likely not combine to higher levels at sensitive receptors given the distance of more than 500 m between the two projects, except in likely crossing points. The main interaction between these two projects would likely be the traffic generated by the movement of construction materials and personnel to the work sites over a period of 9 - 12 months. In addition, some existing roads might be crossed by the sewage construction.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Project</th>
<th>Potential Interaction with TAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nestorio Irrigation Dam in Nestorio Municipality (KP 525 – 530)</td>
<td>The interaction of the construction of the Nestorio Irrigation Dam with the Project will be limited in duration for a period of approximately 6 months during the construction of the major river crossing Aliakmonas II (KP 528) within the section between KP 497 – 543, in case the two projects have overlapping timelines. GPY 17 (KP 529) and Camp 8 (KP 515) will be located within a radius of about 10 km. The Project will likely cross the river using trenchless techniques or implement all necessary mitigation measures to avoid any combined impacts to river water flow in case the dam construction is planned to affect the river discharge and flow. Pressure on mineral resources (aggregates, bedding materials) in the area of both projects is likely to be increased. There is also potential for interaction between these two projects from traffic generated by the movement of construction materials and personnel to the work sites over period of 6 months.</td>
</tr>
<tr>
<td>Wind Farm ADEMCO (Aioliki Dytikis Makedonias) (KP 538 – 540)</td>
<td>If the wind farm construction programme were to overlap with the TAP programme in this area for a period of about 3-4 months during construction of the section between KP 538 – 540. This area of development is a bear habitat of high value. Disturbance to habitats and fauna and potential temporary fragmentation are therefore considered significant and mitigation measures will have to be adopted during construction to avoid combined effects. The main interaction between these two projects is likely to be limited to traffic generated by the movement of construction materials and personnel to the work sites over a period of 3-4 months. Noise and dust emissions from constructions sites will likely not combine to higher levels given the high distance of the area of interaction from any sensitive receptors. Appropriate safety stand-off distances from the pipeline will need to be negotiated with the wind farm developer upon further clarification of the turbines layout.</td>
</tr>
</tbody>
</table>


In the area of GCS Kipoi no other infrastructure developments have been identified.

One main cumulative project impact during construction is the transportation of pipes from the main pipeyards to the pipeyards along the route, and equipment/pipes and workforce to and from the pipeyards, construction camps and sites. Construction traffic on district and local roads may lead to inappropriate over-taking of slow moving construction vehicles and introduce a safety hazard to pedestrians and cyclist on these roads where they are used to low levels of baseline traffic. Potential combined traffic impacts are mainly limited to the direct surrounding areas of the Project where local or dust roads might be used for both projects. Only for one case, the nearby national road Serres to Drama (EO12), might be affected by additional combined traffic due to the small distance to the construction sites.

Noise and dust emissions from construction sites of the future projects and TAP that will be located very close one to the other, could combine to higher emissions of noise or dust from this combination. Given that in most of the cases the distance to the closest residential receptors is
more than 1 km and in some few cases no receptors were identified, these cumulative impacts are not considered to be relevant.

Pressure on mineral resources (aggregates, bedding materials) in the area of the Project might be increased in some cases where large infrastructure developments (sewer networks or roads) are planned. For the analysed nearby projects, the additional demand of aggregates was difficult to assess but it can be assumed based on the known project sizes and development durations that the demand increase will not be considerable.

For the area of Aliakmonas II River crossing where an irrigation water dam is planned, combined effects have been taken into consideration in the freshwater assessment section for the construction phase. All other potential combined impacts to freshwater ecology and riparian habitats are not considered relevant given the water related development projects are mainly wastewater treatment plants and aim to reduce the contaminant freight in discharged treated wastewater during the operation phase.

8.19.3 Mitigation Measures

In general, the mitigation measures described throughout the present section are applicable for mitigating potential cumulative/combined impacts.

Specifically, the mitigation measures required to prevent significant traffic impacts are described in Section 8.16.

Noise and dust emissions have reduced by appropriate siting of projects components and mitigation measures described in Section 8.3. Those that are unavoidable will be managed for TAP through a series of construction site management procedures and the ESMP.

Mitigation measures for noise and landscape are described in Sections 8.3 and 8.6, respectively.

Measures to prevent significant impacts to freshwater ecology and riparian habitats as well as habitats of bears are described in Section 8.8.
Potential increased pressure on mineral or geological resources providing construction materials will be managed for TAP through a series of construction site management procedures, the ESMP and the Aggregates Management Plan (AMP).

8.19.4 Residual Impacts

TAP project has assessed impacts as presented in the previous sections of this report and developed a series of general and specific mitigation measures to reduce the residual impacts. These mitigation measures will ensure that the combined impacts described in the previous section will not exceed the single impacts of the project.

The overall significance of the residual cumulative impacts described above will be expected to be minor or not significant.

8.19.5 Summary

Cumulative impacts may arise from the combination of activities associated with the TAP Project together with other third party developments or projects in the same area of influence and at the same time of implementation.

Given the nature of the pipeline construction site, the overlapping periods of real construction activities of both projects are generally considered to be of limited duration. For the compressor station construction sites no combined projects have been identified.

Environmental impacts due to the TAP Project are related mainly to the construction phase.

With regard to increased noise and dust emissions from combined construction sites effects, residual impacts are considered to be unlikely given that no sensitive receptors have been identified within distances of less than 1 km. Combined nearby construction sites could affect in some cases nearby residents which will experience landscape or visual amenity disturbance. Cumulative traffic increase could occur on local roads in areas near to the construction sites. No combined residual impacts are likely if all mitigation measures for habitats are implemented but
for one pipeline section near to the border with Albania special importance will be given to reducing effects on the bear presence during construction period.

Residual impacts due to the combination of the Project with other developments during construction phase will be managed for TAP through the set of defined mitigation measures and the ESMMP.

During regular operation residual impacts of TAP are mainly of minor significance and will not have effects on increased combined residual impacts.

8.20 Transboundary Impacts

8.20.1 Overview

The Project in Greece starting from the Greek/ Turkish border (Kipoi area) extends to the Albanian border passing through entire northern Greece. The Project passes through Albania and across the Adriatic Sea to Italy. In line with best practice for the development of large linear infrastructure projects that cross several countries in Europe, particular attention is given by TAP AG to potential transboundary impacts of the Project.

TAP AG is aware of the requirements of the Espoo Convention on Environmental Impact Assessment in a Transboundary Context, which was ratified by Greece and enacted with Law 2540/1997. All three countries hosting the TAP project have signed the Espoo Convention. Neighbouring country Turkey is not a signatory to the Espoo Convention. In addition, standards of international financing institutions require that the topic is duly addressed in the ESIA process for the overall project.

This Section discusses the transboundary issues arising from the TAP across the Greece/Albania and Greece/Turkey borders. The legal obligations and procedure to assess transboundary impacts are discussed in Section 3.6.1 of this report.

83TAP AG has chosen the environmental and social performance standards of the EBRD as the reference for developing the Project and in particular the ESIA process including stakeholder engagement (see Paragraph 7 of the EBRD Environmental Policy: http://www.ebrd.com/downloads/research/policies/2008policy.pdf)
8.20.2 Identification and Assessment of Transboundary Impacts

8.20.2.1 Greece-Albania transboundary impacts

The transboundary area within Greece where impacts may affect populations or habitats in Albania is restricted to the area where the pipeline crosses the border south of the village of Ieropigi. The potential impacts are related to the normal activities performed during the construction or operations phase, provided that good practice is exercised.

The key impacts during the construction phase of the TAP infrastructure in proximity to the border are in relation to disturbance of biological resources. The most sensitive resources in the area are large mammals such as *Ursus arctos* (brown bear) and *Canis lupus* (grey wolves) which can cross from one country to another. Short-term disturbance from construction activities may affect the species, especially during the breeding season when they are less mobile and more susceptible. In order to avoid these effects, restrictions will be applied to the timing of construction activities, avoiding any works between mid-March and early-August. Any transboundary effects for species are therefore likely to be of minor significance and only as a result of short term disturbance.

The operation of the pipeline has the potential for transboundary effects due to unplanned events such as accidents or explosions (refer to Section 8.19). However, since the transported medium is natural gas, accidental release will result in limited, local, drying of vegetation. Depending on the location of the release this may be a transboundary impact. Natural gas composition includes greenhouse gases, which in case of accidental release would result in transboundary pollution. However, as demonstrated in Section 8.19, such accidental release is very unlikely and should not be considered as a potential impact in the scope of the present ESIA.

During the decommissioning phase of the Project, as discussed for other sections, the impacts are depending on the specific decommissioning approach. Nevertheless, impacts during decommissioning are expected to be similar to the ones described for the construction phase.
8.20.2.2 Greece-Turkey Transboundary Impacts

Regarding transboundary impacts between Greece and Turkey, impacts to large mammals from construction are similar to the ones described previously regarding Greece and Albania. However, bear is not present in the area. Instead, *Canis aureus* (golden jackal) and *Spermophilus citellus* (European ground squirrel) are known to be present in the area.

The most significant natural resource and habitat in the border area is the border line itself between Greece and Turkey, i.e. the Evros River. Evros River discharges to the Evros Delta which is an environmental protected area of international level (it is included in the Natura 2000 network and presents Ramsar sites). Protected birds species, including migratory species, that inhabit the Delta were not observed at the crossing site. Baseline fieldwork performed in the area of the crossing point shows that this specific section of the river is not of high environmental importance. Nevertheless, the Evros River will be crossed using trenchless methods (e.g. HDD) and consequently impacts to the river itself will not be significant. At the specific area the river is not included in any protected area but the river itself is related to the protected area located at river Evros Delta at approximately 30 km. With implementation of a trenchless crossing technique not impact will occur to any of these two features. The only risk associated with the HDD is an unlikely spill of bentonite to the river.

Another aspect related to Evros River and the construction of the project is the hydrotesting. Water for the hydrotesting of a section of the pipeline is foreseen to be abstracted from and discharged after use back to the Evros River (for details see Section 4, Section 8.4 and Section 8.8). Based on the assessment presented in Section 8.8 impacts from hydrotesting to Evros river will be minor. Based on the water availability (see Section 6) there are no potential impacts to downstream users as a result the abstraction of hydrotesting water from the Evros River.

The main transboundary effect, during operation, is due to the siting of the compressor station GCS00 approximately 3.2 km from the Greek/Turkish border. The closest villages on the Turkish side are Ahir (at approx. 12 km), Balabancik (at approx. 13 km), Ipsala (at approx. 11 km), Saricalli (at approx. 9 km) and Turpcular (at approx. 14 km).
Based on air dispersion modelling (see Section 8.2 and Annex 8.1), no significant impacts on air quality on Turkish sensitive receptors are anticipated from the operation of compressor station GCS00. The air dispersion modelling calculations show that the near-surface concentrations of NO\textsubscript{x} and CO emitted by the compressor station as being very low in all cases simulated for the initial phase of 10 bcm/year and the final phase of 20 bcm/year. Hence, the contribution of the compression station to the baseline conditions shall be of no significance. No exceedances of the short term and long term air quality limits of the Directive 2008/50/EEC were projected. The modelled concentrations were very low across all domains of interest and over the potential population receptors. Regarding GHG, and specifically CO\textsubscript{2}, it was calculated that the operation of both compressor stations in Greece would emit 0.8% of the total annual Greek emissions (compared to 2010 baseline).

Landscape and visual amenity analysis for GCS00 (see Section 8.6 and Annex 6.6.4), shows that only the main vent stack and partially the stacks of the compressors will be visible by the closest sensitive receptor on the Turkish side (Saricaali village).

Noise modelling prepared for the operation of GCS00 (see Section 8.3 and Annex 8.3) shows that impacts on the closest sensitive receptor in Turkey (Saricaali village) located at a distance of about 9 km are expected to be negligible. At a distance of approximately 5.5 km from the village, the sound level is calculated to be 25 dB(A), which is equivalent to whispering voices.

Some limited movement of workers between Greece and Turkey should be expected during both construction and operation of the project. This will be the case especially during the construction of the Evros River crossing.

Wastes generated during construction of the pipeline (next camp at KP 40 and pipeyard at KP 18) and the compressor station (GCS construction camp) as well as during operation of the Project will not present a transboundary issue. Hazardous wastes which might inherit a certain risk for illegal transboundary transportation will be generated in very small amounts and are considered not significant. All three countries, i.e. Turkey, Greece and Albania, are signatories of the Basel Convention controlling transboundary movements of hazardous wastes and their disposal, meaning that movements, if any, of hazardous wastes will be in accordance with the principles of the conventions.
For the assessment of potential impacts from the Project activities to surface water on the Turkish side (Evros River), then they could occur mainly due to open cut crossing techniques with tributaries of Evros River. Only small tributaries of Evros River are crossed and consequently insignificant impacts due to the potential increase of sediments are predicted, during construction. No effluents from the operation of the Compressor Station or from the temporary facilities established during construction are expected to occur to Evros River. Consequently, no impacts whatsoever are assessed to transboundary surface water quality due to the Project.

8.20.3 Mitigation Measures and Residual Impact

In general, good construction practices and the mitigation measures described through this entire section are applicable to minimize potential transboundary impacts as well. Some of them are highlighted in this section, regarding both countries, classified in broad categories.

Regarding the Greek/ Turkish border area the most important mitigation measure is the trenchless construction method for crossing the Evros River (i.e. HDD). Regarding the Greek/ Albanian border area, the most important mitigation measure concerns the development of a specific management plan for large carnivores.

- Mitigation measures for impacts to biological resources (construction phase):
  - Development of a specific mitigation plan for Large Carnivores.
  - Appropriate timing for construction to avoid disturbance of fauna. General construction works from mid March to early August should be avoided in order to avoid disturbance to large mammals during the breeding season;
  - Reduced width of the construction strip when crossing ecological sensitive areas with biodiversity of conservation interest, forests, river banks;
  - No fauna species will be intentionally caught or killed during construction;
  - Trenches or holes created during site works will be covered at night or some form of escape ramp placed within the hazard;
  - Where appropriate, temporary or permanent provisions for fauna to cross the working strip/roads using underpasses, tunnels or other measures will be installed;
• Mitigation measures for impacts to non-biotic resources (construction phase):
  o Special trenchless method for crossing Evros River (i.e. HDD)
  o Erosion protection measures and runoff treatment;
  o Site specific mitigation measures for hydrotest extraction and discharge;
  o Reinstatement of the construction strip- physical and biological, reinstatement of the affected drainage system, roads, etc.;
  o Emergency Response Plan in case of accidental bentonite leak during HDD
• Mitigation measures for potential impacts to other resources (construction phase):
  o Management of wastes in country of origin by certified contractors or operators and in compliance with Basel Convention.
• Mitigation measures for potential impacts during operation phase:
  o Monitoring of air emissions at source and proper maintenance of air pollutants sources
  o Management of wastes in country of origin by certified contractors or operators and in compliance with Basel Convention.
  o Leak Detection System and Emergency Response Plan in case of a gas leak

8.20.4 Residual Impacts

Following the implementation of the abovementioned mitigation and monitoring measures No significant residual transboundary impacts are likely to occur from either the construction or operation of the Project.

8.20.5 Summary of Transboundary Impacts

The transboundary area within Greece where impacts may affect populations or habitats in Albania is restricted to the area where the pipeline crosses the border south of the village of Ieropigi. The impacts are mainly related to biological resources, during construction, whilst during operation only impacts from unlikely non-route events are assessed.
The transboundary area within Greece where impacts may affect population or habitats in Turkey is related to the area where the pipeline crosses the border and the operation of the Compressor Station. In addition to what is described for the Greek/Albanian border area regarding biological resources, potential transboundary impacts to Turkey, during construction, are addressed through the use of HDD as a crossing technique of Evros River and a site specific hydrotest management plan. During operation, the main potential source of transboundary impacts to Turkey is the Compressor Station (GCS00), at approximately 3.2 km from the border line. However, the performed air dispersion and noise propagation models calculated that no significant transboundary effects are anticipated, whilst the impacts to the landscape will be also negligible. During operation only impacts from unlikely non-route events are assessed.

Mitigation measures described throughout the present section are applicable for the transboundary effects as well. With the implementation of these measures no transboundary impacts towards Albania and Turkey are expected during the construction, operation or decommissioning phase of the Project in Greece.

8.21 Project Response

Local perceptions of the Project are presented in Section 7. However, a number of comments, concerns and expectations were raised and some issues were identified which require particular attention during the further detailed project planning. The consideration of the results of stakeholder meetings by the Project is presented in Table 8-107.

Table 8-107 Project Response to Stakeholder Concerns

<table>
<thead>
<tr>
<th>Issue &amp; Description</th>
<th>Project Response</th>
<th>ESIA Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project description &amp; footprint</strong></td>
<td></td>
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<tr>
<td>• Legal framework of the project.</td>
<td>This ESIA provides a detailed description of the project footprint including location of logistic sites and details on the timing for construction, operation and decommissioning of the pipeline. Detailed project information on the exact route and the location of the logistics will be presented again to all stakeholders during the ESIA Disclosure in 2013.</td>
<td>Section 2</td>
</tr>
<tr>
<td>• Exact route, land and settlements that will be affected by the Project.</td>
<td>Based on the comments received during the ESIA consultation in January 2013:</td>
<td>Section 3</td>
</tr>
<tr>
<td>• Method of constructing the pipeline and materials used.</td>
<td>o (i) the pipeline was rerouted in the area of Provatas/Monoklisia to avoid restrictions on further development of both communities and on their graveyards</td>
<td>Section 4</td>
</tr>
<tr>
<td>• Consideration for the depth of the pipeline due to the size of ploughs (various depths: 40 - 80 cm).</td>
<td></td>
<td>Section 7</td>
</tr>
<tr>
<td>• Location of project facilities including the block valve</td>
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<td>Annex 3</td>
</tr>
</tbody>
</table>
### Issue & Description

- Management of compensation for:
  - Loss of permanent crops and trees within the 8 metre strip above the pipeline;
  - Areas that are highly productive in terms of fruit tree plantations and vineyards, and consideration for the time that it takes to gain productivity;
  - Subsidies in which the grower has to plant a particular number of trees or crops.
- Government’s involvement in the compensation process.

### Project Response

- (ii) The pipeline was rerouted in the area northwest of Kavala (turf area) to avoid potential impacts on adjacent settlements (including a hospital) and nearby cultural heritage sites as well as potential impacts due to difficult geological conditions (turf area).
- (iii) The compressor station CS01 at Serres was shifted to reduce potential impacts on settlement.

### ESIA Reference

- Section 8.11

### Loss of livelihoods & compensation

- TAP AG is fully cognisant of the dependence on land for income generation in the study area and is therefore committed to minimising disturbance resulting from temporary and permanent use of land by the Project and then compensation for remaining impacts in a manner that at least restores livelihoods of those affected.

  - With the exception of areas of difficult terrain in mountainous regions, construction will be completed and land reinstated within a calendar year. Consequently the loss of seasonal agricultural production will predominantly be over a one-year period, which will commence in the winter. It is recognised however that the land productivity may take time to fully re-establish and permanent crop production will take longer to re-establish. There will also be restrictions to the regrowth of permanent crops in the 8 m permanent pipeline protection strip of the pipeline.

  - TAP AG has developed a Strategy for the Acquisition of Land and Easement (TAP-HSE-ST-0002 – 2), which commits TAP to mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons’ use of or access to land. The central elements of this Strategy are as follows:
    - Providing compensation for loss of land, land rights and assets at replacement values;
    - Providing compensation for temporary loss of access rights and any standing annual or perennial crops at the replacement value
    - Ensuring that land acquisition activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected;
    - Paying particular attention to the needs of vulnerable groups.

  - In order to realise these objectives, the Project will establish a Livelihoods Restoration Framework (LRF) in line with the EBRD Performance Requirements

  - The LRF is the framework by which TAP AG will establish the entitlements of affected persons or communities and will ensure that compensation is provided in a transparent, consistent, and equitable manner. This process will be directly managed by TAP who will be responsible for negotiating agreements with individual landowners and compensating accordingly.
### Issue & Description

<table>
<thead>
<tr>
<th><strong>Issue &amp; Description</strong></th>
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<tr>
<td></td>
<td>The LRF will take into account the specific points raised by stakeholders as detailed in the impact assessment. The LRF will include an Entitlement Matrix, which identifies the type of impact from land and easement acquisition for each project activity and provides detailed guidance on how stakeholders will be compensated. This document draws on several policy documents including: TAP AG’s Policy on Corporate Social Responsibility (TAP-HSE-PO-0002), the Land and Easement Acquisition Strategy (TAP-HSE-ST-0002) and the Draft Land Access Plan (TAP-HSE-MO-0004).</td>
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<td></td>
<td>TAP AG’s Policy on Corporate Social Responsibility (TAP-HSE-PO-0002) contains the commitment to avoid, minimise, mitigate, offset and/or compensate all adverse impacts resulting from project development and a commitment to build infrastructure (access roads, camps, water supplies, landfills, sewage systems etc.) in a way which allows neighbouring communities to benefit from them even after TAP AG has left.</td>
<td>Section 8.11</td>
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<td>TAP also has a Stakeholder Engagement Strategy (TAP-EXT-ST-0006), which commits TAP to continue effective engagement with stakeholders in particular those in the immediate vicinity of the construction works through the action of the community liaison personnel. The Project is also committed to making them well aware of whom to address and how to raise any concerns and grievances.</td>
<td>Section 8.12</td>
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<td>The open cut method is the preferred option for crossing irrigation and flooding channels. TAP AG is committed to minimising disruptions through planning of construction works in cooperation with local communities and therefore if feasible these crossing will be planned during a time that irrigation is not required. Otherwise irrigation water flow will be maintained during construction. The restoration of the irrigation channel will be undertaken within one month of trench filling and assured with the land owners through a pre and post construction survey.</td>
<td>Section 9</td>
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<td>The LRF incl. the Entitlement Matrix and other TAP policy documents outlined above have been designed to address impacts resulting from changes to land and livelihoods. These documents specifically address mitigation of impacts during the operation phase, inter alia changes in land values, loss of opportunities and respective compensation. In particular:</td>
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<td>• affected land owners and/or right holders will be entitled to cash compensation at replacement values for the reduced opportunities to use the land most productively (lost stumpage value).</td>
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</table>

### Disruption to irrigation systems and bore holes.

- Building restrictions and management on building plans, future investments to land and the future value / selling potential of land.
## Potential benefits

- Use and value of taxes gained from the Project.
- Community investment plans and benefits for Greece.
- Use of taxes and if they will be fed down to municipalities.

The primary economic impact during the operations phase will be the payment of taxes by TAP AG to the Greek government. The exact amount will be specified in the Host Government Agreement therefore no specific measures have been devised yet. However, taxes will generate a long-term (project duration) impact.

However, the Project will develop a Social and Environmental Investment Plan in close consultation with project affected communities and other stakeholders. Community investment measures will be designed according to the specific needs of local communities, aiming to create direct benefits on the local level.

## Access to gas

- Infrastructure to enable settlements to connect to the gas supply as a cheaper source of energy.
- Process for settlements to obtain gas.
- Agreements made regarding the owners and gas supply.

There is a high degree of expectation in Greece that the Project will bring local, as well as national level benefits to the country. The Project is not currently planned to provide gas to the local market, although this provision may be provided if required contracts are agreed.

However, TAP AG is aware of the situation concerning energy and the needs expressed by communities in this regard. As stated above, TAP AG has committed to take forward a social and environmental investment plan that should enhance living conditions in neighbouring communities and address needs expressed during ESIA consultation. The social and environmental investment plan will be developed with the participation of local communities.

## Employment

- Opportunities for employment during construction and operation.
- Number of employees and duration.

As presented in Section 7, it is acknowledged that employment is a key concern to communities in the study area. Employment benefits will be limited by the short construction period and relatively small number of positions open to unskilled workers. Detailed breakdowns of the number and duration of these positions are not yet available. However, the Foundation for Economic and Industrial Research (IOBE) has conducted an economic benefit survey to understand the number of jobs that will potentially be created by the Project. IOBE state that there will be 2,700 direct jobs through construction and an additional 2,400 created through outsourcing of work.

TAP AG’s Policy on Corporate Social Responsibility (CSR) contains the commitment that “TAP and its sub-contractors will recruit and source locally, work with local businesses and give preference to both.” The Project plans to achieve this objective through the implementation of a Local Content Strategy aimed at enhancing capacity of national level companies and increasing local (Project Area) employment and procurement wherever possible. Specific mitigation measures that will be taken forward under this strategy are detailed in the impact assessment.

In addition, an employment strategy will be taken forward to open access to local people for employment.
<table>
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<th>Issue &amp; Description</th>
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<tbody>
<tr>
<td>This will include local locations for employment and the provision of clear information at a municipality level, at all neighbouring settlements, and in communities near worker accommodation camps. Information will also be provided to Roma groups in the area where it is possible to engage them.</td>
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<td>During operations, the Greek section of the Project will employ considerably less than 200 permanent employees. The exact staffing numbers and organisational needs will be made available following the completion of the detailed design.</td>
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**Environmental impacts**

- Impacts to rivers and channels as well as damage to the forest.
- Restoration / reinstatement of land and impact on fertile soil.
- Management of archaeological and cultural sites impacted by the Project.
- Infrastructure developments for the Project such as the creation of access roads and how they will be maintained after construction.
- Management of impacts on irrigation systems.
- Management of pollution given previous experience with existing power plants.
- Impacts on future developments such as village expansion and tourist sites.

The route has been selected with the aim to reduce potential impacts on environmental and social environment as well as on cultural heritage as much as possible.

To achieve this, route feasibility, route refinement, route verification studies and the ESIA process have been carried out.

**Health & safety**

- Risks related to gas explosions and leaks, especially where the pipeline is close to settlements.
- Risk of ploughs causing damage to the pipeline.
- Risks to the pipeline related to natural disasters such as earthquakes.

TAP AG’s approach to health and safety of communities is driven by the conviction that any community concerns or a perception with regards to reduced health and physical safety by the community need to be addressed. Being aware of its responsibilities and duties towards its stakeholders, in particular local communities in the study area, TAP AG will implement plans and procedures based on internationally recognised health and safety standards and the use of best available technology.

The cornerstone of TAP AG’s approach to safety will be emergency response plans (ERPs) taking into account access to health care, major incidences, multiple casualty events and pandemics. These will be developed in consultation with national emergency providers and local health care facilities and will cover all contractors and subcontractors as well as consideration of the local community. Specific commitments have been made in terms of enhancing emergency response capacity at local level if required.

In the context of stakeholder engagement- and
### Issue & Description

Community liaison activities, TAP AG will provide continuous and comprehensive information related to health and safety issues and in order to respond to specific stakeholder concerns including an education process that will be implemented at settlements along the route prior to the completion of construction.

### Stakeholder engagement & information disclosure

- **Methodology for selection of settlement consulted and the reason for the exercise.**

  During the main ESIA phase of stakeholder engagement a total of 2988 participants were consulted during 294 consultation events.

  In total, 111 settlements including community heads within the pipeline corridor were consulted (6 of the settlements consulted are located outside the pipeline corridor). These communities potentially will experience impacts (positive or negative) as a result of the project. All the consulted communities have land within the pipeline corridor. Stakeholder engagement activities were undertaken in different formats in order to meaningfully address all stakeholders including vulnerable groups on the local level, In this context, community meetings, focus group discussions and key informant interviews were held directly in the settlements. The overall objective of stakeholder engagement in this phase of the Project was to provide information about the project, to discuss impacts and mitigation measures to answer questions and understand concerns of those that will be most affected by the Project.

  The next phase of engagement will be ESIA disclosure. This involves dissemination and presentation of the final ESIA report in Greek to all stakeholders, including all affected local communities and settlements.

  Prior to ESIA disclosure, the ESIA will have been submitted to the government prior to the report being presented to the public. The ESIA disclosure process will enable TAP to provide further information on re-routings as a result of their inputs during previous phases of consultation, and greater detail on project impacts and mitigation measures. It will also provide an opportunity for further questions and answers regarding the project enabling continued participation of stakeholders in the Project.

  Comments raised by stakeholders will be documented as an addendum to the ESIA along with how the Project has taken these comments into account.

  In the ESIA disclosure engagement phase particular emphasis will be placed on consulting directly with settlements that were not directly engaged in the main ESIA phase and with the Roma. The Project will also consider alternative means to provide information and gain feedback with individuals who are unable to attend meetings through the media and other channels. In the meantime, further data gathering and engagement will be undertaken through the Human Rights Impact Assessment that is being undertaken by TAP.

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*91 km corridor for the pipeline corridor running parallel to the existing pipeline network and 2 km for the pipeline corridor deviating from the existing Greek pipeline network.*
**Issue & Description**

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<tr>
<th>Project Response</th>
<th>ESIA Reference</th>
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<tbody>
<tr>
<td>Communities which are based outside the pipeline corridor, but have land extending to the pipeline route, will be addressed with special consideration within the forthcoming stakeholder engagement activities during ESIA disclosure.</td>
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</tbody>
</table>

**Government Role**

- Status of negotiations regarding the Project in Greece.

The Greek Parliament on Tuesday, April 9 2013, ratified the Intergovernmental Agreement (IGA) between Albania, Italy and Greece on the construction and operation of the Trans Adriatic Pipeline (TAP) project. The IGA between the three countries, which was signed in Athens on February 13, 2013, confirms the host countries’ support for TAP and their cooperation for the project’s timely implementation.

The ratification of the IGA by the Greek Parliament continues TAP’s progress in the country, with the project now working on successfully completing the Host Government Agreement (HGA) with Greece. The HGA outlines the parameters of engagement between TAP and the Greek Government, such as permitting process, implementation of technical and safety standards and the land easement procedure.

Source: ERM (2012), ASPROFOS (2013)